UNITED
NATIONS

A

General Assembly

Distr.
GENERAL

A/CONF.151/PC/51
5 July 1991

Original: ENGLISH

PREPARATORY COMMITTEE FOR THE UNITED NATIONS
CONFERENCE ON ENVIRONMENT AND DEVELOPMENT
Third session
Geneva, 12 August - 4 September 1991
Plenary
Item 2 (c) of the provisional agenda

CROSS-SECTORAL ISSUES

Progress Report on Financial Resources

Report of the Secretary-General of the Conference

The Preparatory Committee, at its second substantive session, in its decision A/CONF.151/PC/L.36 noted the Progress Report on Financial Resources (A/CONF.151/PC/18) dated 31 January 1991 and requested the Secretary-General of the Conference to continue to develop the report for discussion at its third session, taking into account General Assembly resolution 44/228 and relevant decisions of the Preparatory Committee. This report should be read along with the Progress Report for the second session referred to above.

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1. The context

There is general agreement that accelerated development and elimination of poverty are a necessary part of a strategy to achieve sustainability and the right of developing countries to develop must not be compromised by conditions or constraints imposed on resource flows in the name of environment.

There is also widespread agreement that there should be a reversal of the net financial transfers from developing countries to industrial countries which emerged in the 1980s but as yet there is no consensus on how this may best be achieved. While individual country situations differ, making broad generalizations difficult, it is manifest that achieving rapid and sustainable development in low-income countries requires additional external resources.

The pace of development depends of course upon a country's own policies and management. (See A/CONF.151/PC/18, section 1.) Accelerated and sustainable development will require resource flows greatly in excess of current and prospective levels of official development assistance. Development is financed mostly from a country's own resources. A major portion of funding, both internal and external, will come from the normal flow of investments and from conventional rate lending. Transfers of technologies and capital investments will often be financed in the private sector. Concessional funding will be needed to support the additional efforts of government or governmental support deemed necessary to provide to the private sector.

While very substantial new funds will be required over a long period of time to meet the needs for environmental protection and support of environmentally-sound development, particularly in developing countries, there is an important potential for meeting at least some of these needs through redeployment of funds within existing national budgets. Budget priorities are already being modified in many developing and industrial countries. This is especially true in industrialized countries where many billions of dollars are currently being spent on subsidies to activities, such as agriculture, that are costly to consumers and tax-payers, create significant distortions in the market economy, and often encourage environmentally-unsound practices. It is also true of anomalies in the fiscal and tax systems in many countries, as for example in the case of fossil fuels in respect of which petroleum is subject to significant taxes whereas coal is often highly subsidized. And the major reductions in military expenditures that are now in prospect as a result of the changed international political and security climate open up prospects for redeployment of large amounts of funds.

Within sectors there are also opportunities for reaching more people with services by shifting to lower cost approaches. The "UNDP's Human Development Report 1991" cites examples of lower cost approaches for education, health care, water and sanitation. Such efficiencies are available in all countries. A budget efficiency approach will not, of course, overcome the need for additional resources to meet both development and environment objectives. On the other hand implementation of efficiencies will make better use of funds derived from all sources.

Developing countries will need substantial additional amounts of highly concessional financing for dealing with national environmental issues in the development context. Also, for global issues, there is a special case for additional financing beyond amounts usually available for supporting more rapid development.

In the context of today's Gross World Product approaching $US 25 trillion, world official development assistance (ODA) levels of about $US 55 billion are modest. They have held to about this level for the past decade. Of the $US 55 billion, OECD members provided in 1989 about $US 47 billion. As a group, OECD member ODA levels have increased during the decade pari passu with growth in OECD's combined GNP, offsetting reductions by Arab and other donors. OECD ODA levels have remained about 0.35 per cent of GNP or only half the United Nations 0.7 per cent target accepted by most OECD members and reiterated in the May 1990 Bergen Joint Agenda for Action. (The 0.7 per cent target is for ODA to developing countries and excludes funding, for example, for most Central and Eastern European countries.) An increase in the growth rate of ODA to 6 per cent annually would still mean 12 years to achieve a doubling of ODA levels, and an even longer period to reach the current target of 0.7 per cent of GNP. Substantially faster than historical growth rates would be in keeping with the communiqué of the OECD Council meeting at ministerial level 5 June 1991 which said: "Ministers recognize that in view of the huge development tasks ahead, particularly given the strong efforts toward democratization and economic policy reform throughout the developing world, substantial additional aid efforts will be required both quantitatively and qualitatively. They take note of the target already established by international organizations for the future level of development assistance (0.7 per cent of GNP)".

The external resources required by the Soviet Union and the countries of Central and Eastern Europe to assist them in effecting their policies of economic reform will add substantially to the demands for capital during the remainder of this decade. While the extent of these requirements remains somewhat uncertain, recent research by the World Institute for Development Economics Research of the United Nations University (WIDER) suggests that these may amount to around $US 50 billion annually, including provision for debt relief. (Paper prepared for the WIDER Conference on the Environment and Emerging Development Issues, 3-7 September 1990.) However, the basis and rationale for such capital flows is separate and distinct from that which motivates resource flows to developing countries.

It is also important to recognize that many of the required environment-related expenditures represent investments rather than costs, although they are usually referred to as "costs". In many cases, such investments will produce a direct economic return; in other cases, they produce less direct, but nevertheless significant, returns in economic and social terms; and in most cases the costs of timely and preventative actions will be much less than the ultimate cost of non-action or delayed action. And in the broader sense, expenditures on environment protection must be seen to represent an investment in maintaining the productivity of the Earth itself and its continued viability as a secure and hospitable home for present and future generations.

2. **Funding needs**

(i) Agenda 21

Agenda 21 will give rise to substantial financial needs at both national and international levels. As work on agenda 21 proceeds it is becoming increasingly clear that there will be a need for increasing the budgets and for strengthening the capacities of the United Nations agencies, organizations and programmes and other international organizations which will be responsible for its implementation. It will be possible to be more precise on the needs for strengthening of international organizations when reactions to the agenda 21 option have been obtained in the third substantive session.

Estimates of funding needs are being carried out in respect of action proposals to be considered for inclusion in agenda 21 and estimates are also being made as to the funds that will be required for implementation of the conventions on climate change and biodiversity. These estimates are expected to be available for consideration by the Preparatory Committee at its fourth session.

With regard to the modalities for providing these resources, the Preparatory Committee may wish to consider the following:

- the adequacy of existing mechanisms and resource flows and the need for new and additional resources;

- the relative roles of the regular budget and voluntary funding in the agencies and organizations;

- the role of catalytic funding from UNEP or "contract work" as executing agencies for UNDP.

(ii) Funding required under environment-related conventions and protocols

(a) Requirements

The Secretary-General of the Conference will continue to report cost estimates for implementing key conventions as and when such estimates become available. Meanwhile the following is presented as background information.

- The Executive Director of UNEP in his February 1991 Introductory Report prepared for the sixteenth session of the Governing Council (UNEP/GC16/4/Add.4, paragraph 9) put the incremental costs to developing countries for carrying out the Montreal Protocol in a range between $US 3 and $US 6 billion spread over the period 1990-2008. Information on the operation of the Ozone Fund is presented in A/CONF.151/PC/58.

- A report on Costing Exercises of measures adopted to limit possible climate changes (A/CONF.151/PC/23) was submitted for the second session of the Preparatory Committee. Further estimates as developed for the Intergovernmental Negotiating Committee will be reported as and when they become available.

- A study prepared for UNEP's Ad Hoc Working Group of Experts on Biological Diversity refers to costs ranging from hundreds of million of dollars to billions of dollars. In this connection, it may be noted that current levels of assistance for conserving biodiversity are about one quarter of a billion dollars.

(b) Funding principles for new conventions

In the Progress Report on Financial Resources prepared for the second session of the Preparatory Committee (A/CONF.151/PC/18) the Secretary-General of the Conference suggested that the Committee might wish to consider the principles which should obtain in connection with funding arrangements for future conventions. These might include:

- What considerations should determine the extent to which convention implementation would require external assistance and the category of countries which should be eligible for this assistance. Should a GNP measure be used and if so at what level of per capita income?

- Should the funding arrangements provided for in new agreements meet full incremental costs to developing countries of acceding to them, as in the case of the London Amendments to the Montreal Protocol? Should such funds be passed to the organizations, funds or households, who would bear the incremental cost on concessional terms as an incentive to make the necessary investment? How would "full incremental costs" be determined?

(iii) Capacity building in developing countries

The identification of the capacity requirements in respect of the particular issues at the global and regional levels is now taking place in the course of the development of the agenda 21. Capacity building in developing countries can be greatly facilitated by external financial and technical assistance. Of the $US 55 billion total world ODA level cited above in section 1 it is estimated that $US 15 billion is utilized for technical assistance, much of it for relatively expensive international experts. Both UNDP and OECD/DAC have recently been reviewing experience with technical assistance and, based on consultations with recipient and donor country managers, both see substantial room for strengthening the process. A key problem has been the uncoordinated provision of relatively costly short term assistance not well related to the assistance provided by others. There has not been sufficient emphasis on utilization of national personnel and on institution building. There is a perception

that the process can be strengthened by developing countries' articulation of capacity building strategies (for example, for agricultural research or for management of toxic chemicals) and donors agreeing to provide assistance on a more sustained basis within the framework of these strategies. If this view is accepted then the case can be made for a combination of more assistance for capacity building and a better use of existing assistance modalities.

Specific options for capacity building will have to be identified in the context of specific problems and programmes. Most of the capacity needs identified in agenda 21 can be met through strengthening of capacities at the national level. But given the transboundary dimensions of many environment and resource-related issues it will often be desirable to relate the development of national capacities to global and regional needs and to plans for development of similar, complementary, capacities at the global and regional levels.

Accordingly, as indicated in the paper on Technology Transfer (A/CONF.151/PC/53) the Secretary-General of UNCED has invited the regional development banks, the United Nations Economic Commissions and other principal regional organizations of the developing world to join with UNDP and UNEP in surveying existing institutional capacities in their respective regions, in relation to the environment and development issues to be addressed by UNCED, and in particular through agenda 21, and to identify the potential and the needs for strengthening of such capacities and establishment of networks which would constitute a "sustainable development and technology support system" for each region.

While specific estimates of the costs of such capacity building will have to wait until the completion of these surveys and the related work on agenda 21, it is already evident that there will need to be greatly expanded international support to meet the capacity-building requirements of the developing countries and regions to meet their own needs and ensure implementation of agenda 21.

(iv) Additional needs of developing countries

It may be helpful to the Preparatory Committee to begin to consider the magnitude of the costs over the next generation of achieving the goals on which Member States agree.

The funding requirements for accelerated development have been estimated in the United Nations General Assembly in terms of effort by donors rather than in terms of needs of recipients. The target, as mentioned above, was established at 0.7 per cent of donor GNP which would be about $US 110 billion at 1989 prices and exchange rates and GNP levels. In view of the uncertain comparability of GNP statistics among donors this figure should be taken as indicative of an order of magnitude.

A recent study by the World Institute for Development Economic Research of the United Nations University (WIDER) examined the issue from the point of view of developing country needs. It estimated that the additional annual capital inflows above current levels required by developing countries to attain a socially necessary rate of growth would rise to $US 60 billion in the year 2000. While there is as yet no considered movement towards attaining these levels, it is interesting to note that they also correspond with the doubling of current aid levels. (See "Toward a Global Environmental Compact" by Lal Jayawardena, WIDER, Helsinki, 17 June 1991.)

The "socially necessary rate of growth" which such a doubling would make possible is related to the need to deal with the backlog in meeting basic needs objectives, to the need to increase employment levels and to the need to improve income distribution. Such a rate of growth would also ensure achievement of the goals of the World Declaration on the Survival, Protection and Development of Children adopted at the World Summit for Children in 1990. It would provide the basis for a major attack on poverty which, as pointed up in document A/CONF.151/PC/45 is an imperative in both environment and development terms.

The same WIDER study estimates that if requirements of developing countries for environmental protection were added to those of socially necessary growth, these additional capital requirements would amount to some $US 60 billion in 1990 rising to somewhere in the region of $US 140 billion by the year 2000. These are clearly very large amounts in relation to current levels of ODA or private investment. Nevertheless, WIDER argues that having regard to the large shifts in payments surpluses and deficits now in prospect, it should be entirely feasible for the international community to provide for these substantial increases in resource flows to developing countries as well as meeting the requirements of the Soviet Union and Eastern Europe. The issue is primarily one of political will and priorities.

Considering at this point only a doubling of current levels of development assistance, the question can be asked as to how such additional funds could most effectively be employed to achieve a real acceleration of development and reduction of poverty. In this connection some observers have argued that substantial additional funding could be best used in response to developing country strategies which would at the same time achieve a more effective enabling climate for activity at all levels and direct significantly more resources to rural infrastructure and human development activities. This is discussed further under "Partnership in Additionality" in section 4 (vii) below.

However, as indicated, doubling of current levels of aid will still not provide for the additional resources required by the developing countries specifically for environmental protection. While the WIDER estimates referred to above may be indicative of the orders of magnitude of such requirements, more explicit estimates will be forthcoming as a result of the work now being undertaken by the UNCED secretariat in relation to the development of agenda 21.

Official financial flows are necessary, but they cannot replace and must complement and support substantially increased flows of private investment. Private investment is characteristically accompanied by technology transfer, training, marketing, design and management skills which can contribute significantly to the host country's development and environment objectives. Yet there has been a severe decline in private investment in developing countries in the past few years which needs to be reversed. This will require special measures by Governments to inspire confidence and provide incentives and a conducive environment for private investment under conditions that are compatible with their national objectives, interests and values.

(v) Environment programmes

The Environment Fund of UNEP, established in 1972, "to provide additional finances for environmental programmes", will require increased contributions in the period ahead. The UNEP Governing Council at its sixteenth session from 20-31 May 1991 approved an appropriation of $150 million for Fund programme activities for the biennium 1992-1993 and an additional programme of $30 million to be used only if and when additional resources become available. The Council affirmed the desirability of working towards a level substantially higher than the present level of contributions by 1995. Future funding requirements will need to be reviewed in light of decisions taken at UNCED, particularly in respect of the important role that UNEP is expected to play in implementation of key elements of agenda 21.

3. Sources of funding

Financing of the budgets and programmes of United Nations agencies and organizations and of other intergovernmental organizations which will be involved in the implementation of the decisions taken at UNCED, is provided either through mandatory assessments or voluntary contributions, and most often by a combination of both. Funding required under conventions is provided by assessments that are mandatory under the provisions of the convention or its protocols although these may be supplemented by voluntary contributions. Non-governmental organizations which will be involved in follow-up and implementation usually derive their administrative costs and much of their programme funding from private sources, including their own membership, but to an increasing degree also receive governmental funding, usually in respect of particular programmes and projects.

Given the very substantial amounts of additional funding that would be required to implement the proposals that will be considered by UNCED, in the event of their approval, it does not seem realistic to rely primarily on increases in voluntary contributions to meet these needs. There are limits to the amount of voluntary funding that the Governments which provide most of this can be expected to provide as well as limits on the degree to which agencies, organizations and programmes can be expected to rely on ad hoc, year-to-year voluntary funding for programmes and activities of an essentially long-term nature.

The issue of burden-sharing inevitably arises. Accordingly, it is likely that to meet the substantially increased funding requirements that would arise from UNCED decisions would require large increases in mandatory contributions under agreed burden-sharing arrangements while continuing to provide for voluntary funding to complement and supplement, but not to substitute for, this. Under current conditions, it seems evident that it would be difficult to meet these requirements for "new and additional resources" by large increases in either mandatory or voluntary contributions that represent a direct charge against national budgets. There are, however, indications that some Governments may be willing to provide increasing budgetary allocations to fund global environmental needs. The Government of Norway, for example, which is already providing over 1 per cent of GNP for official development assistance, has suggested an additional contribution for global environmental programmes of 0.1 per cent of GNP. Switzerland has announced a special allocation of 300 million francs for "additional" support of environment-related programmes in developing countries. A number of donors have obtained funds outside of usual aid sources in making contributions to the Global Environment Fund.

There is also a great deal of potential for redeployment of funds within national budgets through reductions in military expenditures, reductions in subsidies to activities that are often environmentally unsound as well as costly in economic terms and changes in fiscal and taxation systems. A number of Governments and organizations are undertaking analyses of these possibilities.

General Assembly resolution 44/228 called for new and innovative approaches to meeting the needs for additional financial resources. Responding to this, there is set out below a summary of some of the principal means of meeting these requirements which have been examined by the secretariat:

(i) Debt relief

Over the past decade there has been considerable discussion of debt-for-nature swaps and other types of debt relief. Nineteen debt-for-nature agreements have been reached providing relief on debt with an original value of some $US 100 million with a generation of funds for environmental purposes of about $US 60 million. The scope has been limited in part by the need to avoid inflationary impact at the national level. New types of debt-for-nature programmes involve creation of trust funds aimed at long-term funding.

The Financial Times (12 June 1991) reported a transaction involving a donation by BankAmerica of part of its portfolio of developing country debt valued at $US 6 million to World Wildlife Fund and Conservation International. These groups will purchase external debt at a discount on secondary markets. They plan to utilize funds for environment-related

projects in Mexico and other countries. Meanwhile the Government of Poland has entered into negotiations with the Paris Club for a debt-for-nature swap of $US 3.3 billion. The proposal calls for establishment of a fund in Poland under joint Poland-creditor management to support critical environment programmes. If this agreement is completed, it will establish a new pattern which could involve significant reductions in debt portfolios as well as very substantial funding for sustainable development.

In continuing to consider this issue it has been suggested that very heavy indebtedness might be dealt with in a way analogous to the "Chapter 11" process utilized in the United States. A firm which has lost its credit worthiness enters into a Chapter 11 process of negotiation with banks. One result can be subordination of old debt to new, thus permitting an injection of new funding to get the production process operating again. In the case of heavily indebted Governments, where much of the debt is often owed to or guaranteed by Governments, this would be subordinated along with private debt. For the special but important case of debt owed to multilateral organizations it might be necessary to create donor support groups to avoid damage to their credit worthiness. In the context of coordinated accelerated development schemes as described in section 4, debt relief might well be an important element of an assistance package since it would strengthen credit worthiness while usually freeing up funds to finance imports.

The World Resources Institute has proposed a "multilateral authority" to reduce developing country external debt. (Partnership for Sustainable Development, May 1991.) The authority would purchase debt at a discount and then negotiate for phased forgiveness in response to adoption and implementation of sustainable development programmes. Examples include plans to control deforestation, to adopt appropriate energy pricing and least-cost energy strategies, to reduce population growth, to undertake land tenure reform, to raise the legal, social and economic status of women, and to implement manufacturing strategies emphasizing job creation. A similar scheme has been suggested in a paper prepared for UNESCO's Man-in-the-Biosphere programme. It proposes a Debt-for-Biosphere Reserve Management Investment Fund. "UNDP's Human Development 1991" suggests debt relief for promoting priority social expenditures. Similarly debt relief could be utilized for agriculture development or job creation.

Debt relief could be effected by individual arrangements with each debtor nation. But it could also be done through contribution of debt instruments by creditors to a central fund which would utilize them as a basis for funding long-term programmes of sustainable development agreed with debtor countries.

(ii) SDR-linked funding

Special Drawing Rights (SDRs) are created within the structure of the IMF in order to increase international liquidity. The distribution of SDRs could, in principle, be used to effect resource transfers and there have been several proposals for SDR-linked aid flows. In relation to the funding needs identified here, a portion of the SDRs that need to be created to augment international liquidity could be "allocated" either directly to developing countries or to a central environment-development source fund for agreed programmes of global importance which would in effect transfer resources and generate the required liquidity in the international monetary system.

(iii) Charges for use of the commons

The idea of gaining revenue from the global commons was articulated in the Law of the Seas negotiations. There could be potential revenue from sea bed resources, ocean fishing, use of the high seas by shipping, use of the atmosphere and stratosphere for air transport and for communication facilities which utilize global commons. There are potential revenues from use of outer space. Taxing the use of the commons could be administered by national Governments on behalf of the international community with revenues deposited in an internationally managed fund. Alternatively, an international taxing authority could be established under the United Nations with the revenues to be used for environmental protection and related development measures.

(iv) Private Investment Fund

Many environmentally-sound investments also are profitable. Energy saving measures are a good example. Other environmental investments become necessary to comply with new regulations. Thus in recent years a large number of firms have been established to capitalize on the new opportunities. Most of these operate primarily in industrial countries. In this context it is suggested that special measures may be needed to encourage more investment in environment-related efforts in developing countries. This has led to the idea of a private investment fund established to invest in and/or lend to developing country firms in cooperation usually with private sector enterprises and/or development banks. Such a fund would help overcome the problems which exist in reaching the developing country private sector through government-to-government aid processes. The Fund could, of course, be authorized to also lend to or invest in government-owned facilities under certain defined conditions.

Funding for such a private fund would come from the international investment community including from individuals. Management would be provided by a full-time team of professionals with the highest standards of qualifications and experience. Provision would be made to preclude control by any single individual or group through limitations on share ownership or voting rights. The Fund might be launched with the endorsement of Governments - perhaps at UNCED.

In order to establish the financial integrity and credibility of the Fund, initial capitalization should probably be at a level of at least $1 billion. Fund securities should be available to individuals throughout the world, making it eventually into a true peoples fund. One idea is to create Earth Bonds which would be a vehicle for savings in small denominations.

Governments might encourage institutions and individuals in their countries to invest through tax incentives, payroll deductions or guarantees.

A separate non-profit entity might also be set up, not directly linked to the investment fund but which might be subject to the same management. It would provide "soft" funding for sustainable development projects which may include improving the terms of an investment from the private investment fund. For example, a longer gestation forestry project which is otherwise economically attractive might need a longer grace period than would normally be available solely through a conventional investment. Another example would be a waste recycling project where social returns exceeded private returns and warranted lower interest rates. The Foundation would be funded by private and governmental donations and would conduct regular fund-raising campaigns.

(v) Earth Stamps

A group of more than 100 NGOs from some 30 countries proposed to the second substantive session of the Preparatory Committee the idea of Earth Stamps. Funds would be raised by asking Member State Governments to permit their postal system to sell Earth Stamps which would then be added to regular postage, probably voluntarily. The NGOs reported that such supplementary postage systems have in the past been used by Germany to help finance the Berlin airlift (in this case the postage was compulsory), and by the Netherlands and Switzerland to generate funds for relief, for health programmes or to support participation in the Olympics. Another possibility would be the selling of stamps outside the postal systems. This is already widely used as a fund-raising device by private organizations.

The group of NGOs estimate that very large amounts of money could be raised through such a scheme even if purchase of the stamps were voluntary. In the further development of the idea it would be especially important to decide how the funds would be managed and utilized in order to assure Governments and individuals that their investments would be well used.

Critical to the willingness of individuals and Governments to purchase such stamps would be their desire to support the uses to which the funds would be put. One suggestion for the use of the funds is that they might be channelled through a United Nations organization to finance transfer of technology to developing countries. Another would be that they be used as a source of funds for the kind of non-profit foundation referred to in paragraph (iv) above.

(vi) Allocative measures with a revenue potential

Certain measures taken primarily to influence behaviour of firms and households could have a substantial revenue potential. Such measures would generally be developed and calibrated with substantive objectives relating to resource use or pollution rather than as revenue measures. Two such measures suggested in recent discussions are described below:

(a) A non-renewable energy or "carbon" tax

There is increasing consensus on the desirability of measures to reduce greenhouse gas emissions and "carbon" taxes have been proposed by some for this purpose. Though the primary objective and the negotiating context of such taxes is mitigation of the risks of climate change, the revenue potential in some industrial countries is of a magnitude that only a relatively small proportion devoted to the task of accelerated development and environmental protection in low-income countries would result in major increases in ODA availabilities. Since an accelerated development strategy will also require resource mobilization in developing countries, such new revenue sources could be built into their strategies.

The World Resources Institute has proposed a system of coordinated national levies on greenhouse gases or their sources and the creation of a global Environment Trust Fund. This is described in "Natural Endowments: Financing Resource Conservation for Development", the 1989 Report of the International Conservation Financing Project commissioned by UNDP. While the amount of revenue would vary depending upon the tax level established, the report indicates that a tax equivalent to a 10 per cent tax on coal would produce industrial country revenues of more than $US 25 billion annually. Some have argued that the revenue measures should be applied at several stages in the production and consumption cycle. There are a variety of options for utilizing and managing such revenues ranging from an agreement to channel a portion of them through existing institutions to the establishment of a fund under a United Nations institution.

Another estimate on potential revenue from a carbon tax has come from Dr. José Goldemberg, Secretary of State for Science and Technology in Brazil (quoted in WRI's 15 May 1991 testimony to the United States Senate Foreign Relations Committee). He states that a $1 per barrel tax on oil or its equivalent would generate $50 billion yearly. A tax at this level would be basically a revenue measure to finance global efforts rather than being an important disincentive to consumption. To modify consumption levels would require a tax substantially higher.

Worldwatch Institute in its State of the World 1991 (page 183) reports on a United States Congressional Budget office estimate that a phased-in tax on each ton of carbon beginning at $11 in 1991 and going to $110 in 2000 would yield by the year 2000 revenues in the United States of $120 billion. Such a tax was projected to lead to a 37 per cent reduction in carbon emissions and a 23 per cent improvement in energy efficiency. Of course the revenue impact would be reduced to the extent offsetting tax reductions were implemented.

A more modest proposal has been suggested in a UNCTC working paper for "Financing Sound Energy Technologies in Developing Countries". Taxes of perhaps 1 per cent would be imposed on fossil fuels at the source of extraction and on consumers at the retail level to raise a few billion dollars for a "World Energy Alternatives Commission". Funds would be used to develop energy strategies and for funding renewable energy and energy conservation projects.

From an environmental point of view it would be logical, and in some respects more equitable, to extend the concept of a carbon tax or tax on fossil fuels to include all non-renewable sources of energy. The practical effect of this would be to extend the energy sources that would be subject to the tax to include nuclear energy. While nuclear energy does not contribute to the build-up of greenhouse gases in the atmosphere which produce the risks of global warming, it is nevertheless a source of other significant environmental effects and risks. Also, the nuclear industry has been developed with the support of very large-scale expenditures and subsidies from public funds and on this basis, too, it could be argued that it should bear its share of the burdens of any taxes imposed for purposes of environmental protection.

(b) Tradeable permits

There is growing experience with the concept of "critical loads" being apportioned by an agreed upon formula and then made available for trading. The critical load should be grounded in a scientific assessment but in practice is likely to also take into account political and economic factors. The overall critical load is related to an environmentally-affected unit. In the case of global warming the unit would be the whole Earth. In the case of acid rain, it might be a region of several countries. For air pollution the unit might be a metropolitan area. Once the environmental unit is decided upon and the overall critical load is established the overall load is apportioned in accordance with agreed upon criteria to subunits such as countries, firms or individuals. The subunits are then allowed to "trade" allocations. For example an efficient firm may not use its whole quota and would be able to sell emission rights to a firm wishing to exceed its allocation. To the extent that critical loads were traded among firms there might not be any public revenue available for programming. The concept in this case should be thought of as an "economic instrument" with the special benefit of achieving critical load limitations in the most economic way. If the critical load was traded among Governments, there could be the potential of substantial transfers from one country to another. The amounts would depend in large part on the original allocations of "pollution rights". In the case of green house gases it is argued that industrial countries have the room to reduce emissions considerably while many developing countries will need to maintain or increase emissions to achieve development objectives. If the allocations to developing countries were larger than needed in the short run, they might then sell rights to over-quota industrial countries, giving them time to adjust to agreed lower levels over a longer period of time. A proposal to this effect has been made by the Secretary-General of UNCTAD.

Another possibility would be the selling of critical loads within countries by the public to private sectors. For example a total critical load of air pollution might be established leading to a regulation on tolerable plant-level pollution levels but with the understanding that the new emission standards would be achieved over a 10-year adjustment period. The Government would be authorized to sell permits to individual firms wishing to exceed the limits in the transition period. This would provide a limited incentive to adjust quickly but short of an absolute requirement. It would also provide a temporary stream of revenue for the Government. The revenue could be devoted to a special purpose such as research for cleaner technologies. Within the framework of the critical loads approach a wide variety of applications can be considered.

4. Financing mechanisms

A fundamental question arises as to whether each of the funding needs referred to above should be met on a case-by-case basis or through establishment of a single "sourcing" fund.

(i) Case-by-case funding

Under the case-by-case scenario, which is the current situation, individual arrangements would be made to meet each particular funding requirement. The funds required for implementation of conventions would come from the assessments provided for under each convention from the countries adhering to it. Funding of the UNEP Fund would continue to be raised through direct appeals to Governments and the same might be true of contributions to a capacity-building fund and other additional contributions of official development assistance. It is also possible to envisage meeting certain specific requirements from particular sources that are related to them, e.g. funding required by developing countries to develop alternative energy sources or to undertake large-scale afforestation programmes might come from a carbon tax or levy. Similarly, environmental funding requirements of developing countries might be provided from taxes or levies on damaging products or activities in industrialized countries.

The very substantial increases in the magnitude of resource flows required to meet all of the principal requirements of developing countries raises the question as to whether it is practical to continue relying as much as is presently done on voluntary funding. While voluntary funding will undoubtedly remain an important factor in meeting the resource requirements of developing countries, it seems likely that there would need to be a substantial element of agreed burden-sharing in any arrangements for meeting the substantially increased needs that are now apparent.

(ii) Establishment of a general "sourcing" fund

An alternative to meeting funding needs on an ad hoc, case-by-case basis would be the establishment of a general "sourcing" fund which would also facilitate the application of burden-sharing. Such a fund could serve as the means for mobilizing funds from a variety of sources and

serve as a repository and dispensing mechanism for such funds. These could consist of both assessed and voluntary contributions from Governments as well as the kinds of "new and innovative" sources of funding referred to above. Funding requirements for implementation of conventions, to the extent that they represent the obligations of States under the convention, would need to be provided by such States, although arrangements could be made for this to be done through the mechanism of a general sourcing fund if this were desirable. And, in any event, supplementary funding in support of the conventions could be provided from the general sourcing fund.

Such a general "sourcing" fund (which might be called an "Earth Fund", "Green Fund" or "ECO Fund") would not itself be operational in the investment and expenditure of the funds it receives. Rather these would be dispensed through existing funding mechanisms, e.g. the World Bank, the Global Environment Facility, UNDP, UNEP, regional development banks and other regional and subregional agencies and organizations implementing programmes under agenda 21. It could be designed to provide the sole or principal source of funding for such specific requirements as the Global Environment Facility, the Fund of UNEP, the capacity-building fund and implementation of the other elements of agenda 21 as well as the additional resources required by developing countries to implement environmental measures for relief of poverty and achievement of sustainable development.

There have been several proposals for the establishment of new global funds to deal with environmental needs. One such proposal for a "World Atmosphere Fund" emanated from the first global climate conference in Toronto, Canada, in June 1988 and was subsequently the subject of a study commissioned by the Government of the Netherlands. The late Indian Prime Minister Rajiv Gandhi, at the non-aligned summit meeting in Belgrade, called for the establishment of a "Planet Protection Fund". He proposed contributions of 0.1 per cent of GNP from all countries except the least developed which would raise an estimated $18 billion (United States) per annum. The March 1989 Declaration of The Hague called for new institutional authority for the United Nations. Developing countries have also proposed creation of a "Green Fund" which was endorsed at a conference of developing-country ministers on environment and development held in Beijing in June 1991.

(iii) The Environment Fund for UNEP

This was established as a voluntary fund to provide financing to cover a major portion of UNEP's administrative and staff costs as well as its programmes. The role of the Fund for UNEP and its relationship with other funding mechanisms could be examined by the Preparatory Committee. The issues raised in paragraph 6 of A/CONF.151/PC/18 will be particularly relevant in this respect.

(iv) Mechanisms for funding related to conventions

The funding linked to the implementation of conventions will be negotiated as part of the process of negotiating the obligations under the conventions. In terms of mechanisms, one option would be to have a separate fund for each convention with perhaps some sharing of management and administrative services between the different funds, each subject to decisions of the governing body set up by the relevant convention. The Preparatory Committee may wish to discuss the elements of this option vis-à-vis the alternative of relying on a general sourcing fund. In negotiating funding arrangements there is the related question of whether or not entirely separate funds should be established for each agreement. In practice, it can be expected that in fact funds would usually flow to developing countries from more than one source. The Montreal Protocol includes provision for association of funding from bilateral donors. This would be the case especially where a given project served multiple purposes with convention-related costs representing only part of the total. The Preparatory Committee may wish to discuss how associated funding will be related to conventions.

(v) Global Environment Facility

Member State comment in the second substantive session was generally supportive of the recently established Global Environment Facility (GEF) operated as a pilot project by the World Bank with UNEP and UNDP. It has been suggested by some countries that as new conventions and protocols are agreed requiring substantial incremental funding for their implementation, the mandate and funding of the GEF and other existing institutions could be expanded. This, it was indicated, would obviate the need for the creation of new funds for implementation of new conventions. An important issue that would have to be resolved, however, before this could occur is the relationship between decision-making processes under the respective conventions and how GEF would be bound by these in allocating its funds in support of the conventions. Under existing arrangements for decisions as to allocation of GEF funds, it is not required that GEF respond to the priorities established or decisions taken by Governments pursuant to the conventions. Also, the GEF is based on voluntary funding whereas the funds linked to conventions would normally involve assessed contributions. An alternative approach would be to confine the GEF to the raising and administration of funds for programmes not covered by specific conventions. A further variation would be to distinguish between funding and administration, establishing, for example, separate funding agreements but using GEF orbother multilateral or bilateral aid management units for actual administration.

Some envisage that in addition to providing the mechanism for financing implementation of conventions, the GEF might become a mechanism for mobilizing and dispensing the funding required for a broader range of environment and related development purposes. Under this scenario, the GEF might be mandated to undertake many of the functions envisaged for the "sourcing" fund referred to above. In this case, it could be

seen as a possible alternative to the creation of such a general sourcing fund. This, however, would require significant changes in the GEF as currently set up. In addition to the need to effect changes in its governance to provide for its response to funding decisions taken in other intergovernmental fora, including conventions, there would undoubtedly need to be consideration as to whether a separate governing board would need to be set up to meet developing country insistence on greater representation in its governance. The question of burden-sharing would also have to be faced as it is unlikely that a major expansion in the funding could be achieved through voluntary contributions unless reasonable burden-sharing was achieved. Other issues which would need to be addressed are terms (grants or concessionality of loans) and the role of GEF funding for technical assistance.

The Preparatory Committee may wish to take into account these considerations in its discussions of the future role of the GEF as a financing mechanism.

(vi) Capacity Building Fund

The substantial new needs for capacity building in developing countries referred to in section 2 of this paper can only be met through sizeable increases in support provided through a number of bilateral and multilateral channels. This might be facilitated by establishment of a consultative mechanism, similar to the Consultative Group for International Agricultural Research (CGIAR).

In addition, it would undoubtedly be useful if one agency played a lead role in "brokering" the mobilization of funds through such a consultative group. Given the leading role of UNDP in the field of technical assistance, it would be logical for UNDP to perform this role, and through it the whole United Nations system be involved. It would have to work in especially close association with UNEP, the World Bank, the Regional Development Banks and other regional and subregional organizations - governmental, intergovernmental and non-governmental. Consideration might also be given to establishing under the auspices of UNDP a special fund to support its catalytic role in capacity building and the related establishment of Sustainable Development Networks. For an elaboration of this approach, see Part III of the Report on Transfer of Technology (A/CONF.151/PC/53).

(vii) Partnership in additionality: contracts for accelerated and sustainable development

It has been suggested that it might facilitate the provision of aid if developing countries were to put forward ambitious accelerated and sustainable development programmes and if willing donors responded with additional funding.

A partnership in additionality would be based on a developing country's clear articulation of policies and strategies and a programme of action for their implementation. The strategies would be designed to enable full use of economic opportunities in a drive for fast growth in

production levels while at the same time reordering internal priorities toward a broad-based attack on poverty, concentrating, for example, on basic education and rural infrastructure. Such strategies would be the basis for a commitment to increased funding from international and bilateral donor sources. A sustained commitment would be needed by both developing countries and donors. It would be essential for such programmes to enjoy broad popular support since the donor-recipient relationship likely could not endure a charge of unwanted conditionality.

Such a process could be coordinated through existing Consultative Group and Roundtable processes. However, in view of the broad nature of the funding required, a special process could be considered where periodically the "contracting parties" could meet to discuss progress and agree on the solution of any emerging problems and on future plans.

Funds would need to be made available in a flexible way and on a sustained basis. Provided such funding was available to all countries where substantial poverty exists and especially those with sufficient management capacity and infrastructure to absorb the assistance quickly and efficiently, it would appear that substantial additional ODA could be readily absorbed. Very significant inroads could be made on the elements of poverty, in effect achieving the "socially necessary" rates of growth which the WIDER study referred to in section 2 defined as necessary to achieve targets for health, education, poverty alleviation, employment and improvements in income distribution. The path through the demographic transition would be quickened. Combined with a concerted effort on capacity building outlined above, developing country population and Governments would be made better able to cope with environmental issues.

A similar proposal has been put forward by Mr. Lal Jayawardena in the WIDER paper referred to earlier. Earlier, it was put forward, in 1989, by Mr. Thorvald Stoltenberg, Foreign Minister of Norway, in a paper presented to the OECD Development Centre's 25th Anniversary Symposium and published in One World or Several, OECD, 1989. He called for financing medium- and long-term development plans prepared by the developing countries themselves. The distinguishing feature of such contracts would be the long-term nature of the commitments to support the effort, ensuring a fair partnership and a central role for the developing countries in question. Participants would include the IMF, the World Bank, other major multilateral agencies and the bilateral donors. The premise of such a comprehensive and sustained system is that it would bring larger and more predictable flows of concessional resources.

5. Summary of Issues for Consideration

(i) The Preparatory Committee may wish to comment further on the question of new and additional resources both for development as traditionally conceived and for identifiable environmental issues of global concern.

(ii) The Preparatory Committee may wish to comment on the critical funding issue vis-à-vis environment, development and international organizations: should environment and development activities be funded from the regular budgets of each agency and taken into consideration by their governing bodies in setting funding levels or should they rely on voluntary funding? What is the role of catalytic funding by UNEP or contract work type funding by UNDP?

(iii) The Preparatory Committee may wish to consider whether financing mechanisms should be developed case by case or should a central source funding mechanism be developed.

(iv) The Preparatory Committee may wish to consider whether and to what extent the financing required to implement new conventions should be provided directly by the parties in these conventions or through a new "sourcing" mechanism as referred to in section 4 (ii). It may also wish to comment on the appropriate role of the GEF.

(v) The Preparatory Committee may wish to comment on the issue of capacity building. Does it agree that special measures are required to support capacity building in developing countries and regions? If so, does it consider that the steps referred to in section 4 (vi) may be a suitable starting point for such measures? Does it agree that this issue can often best be approached at the regional level? Should the UNDP undertake a lead role in respect of capacity building and the brokering and mobilizing of funding for the purpose of capacity building?

(vi) The Preparatory Committee may wish to discuss whether or not the elements of a "partnership in additionality" for an accelerated and sustainable development strategy described in section 4 (vii) are valid. Would developing countries be willing and able to take the politically difficult policy decisions needed for an accelerated and sustainable development effort? Would industrial countries be willing and able to marshall a substantially increased aid effort and through what mechanisms would funds be channelled? Is it feasible to obtain long-term commitments to support accelerated development efforts and to meet developing country requirements for environmental protection? How can this best be done? What kind of consultative process should be developed?

(vii) The Preparatory Committee may wish to consider the various suggestions in section 3 for new and innovative sources of finance and provide guidance to the secretariat as to its further work on this subject.

UNITED
NATIONS

A

General Assembly

Distr.
GENERAL

A/CONF.151/PC/52
28 June 1991

Original: ENGLISH

PREPARATORY COMMITTEE FOR THE UNITED NATIONS
CONFERENCE ON ENVIRONMENT AND DEVELOPMENT
Third session
Geneva, 12 August - 4 September 1991
Plenary Session
Item 2 C of the provisional agenda

SCIENCE FOR SUSTAINABLE DEVELOPMENT

Progress Report of the Secretary-General of the Conference

1. INTRODUCTION

The General Assembly in its resolution 44/228 of 22 December 1989 has emphasized the crucial role of science and technology and stressed the need for effective international cooperation in the field of sustainable and environmentally sound development. The Secretariat of the United Nations Conference on Environment and Development, recognizing the importance of the natural, engineering and social sciences both for the formulation and implementation of Agenda 21, herewith submits a Progress Report on Science for Sustainable Development.

In considering recommendations from the regional conferences and special needs of the developing countries, the UNCED Secretariat is working in close collaboration with the relevant United Nations agencies, including the United Nations Educational, Scientific and Cultural Organization (UNESCO),

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the United Nations Center for Science and Technology for Development (UNCSTD), the World Bank, the Food and Agriculture Organization (FAO), the World Health Organization (WHO), the United Nations Environment Programme (UNEP), the World Meteorological Organization (WMO) and the UNESCO Intergovernmental Oceanographic Commission (IOC), as well as non-governmental organizations, including the International Council of Scientific Unions (ICSU), the International Social Science Council (ISSC), the International Union for Conservation of Nature and Natural Resources (IUCN), the Third World Academy of Sciences (TWAS), the International Institute for Applied Systems Analysis (IIASA) and the Union of International Technical Associations (UITA).

The UNCED Secretariat has received valuable advice from members of the Working Party on Science for Environmentally Sound and Sustainable Development and is indebted to ICSU and UNESCO for their assistance with the preparation of this report.

A necessary precondition for sustainable development is that it must be environmentally sound. But unprecedented environmental transformations will be needed to serve improved development in the coming decades. How will humanity achieve these without losing longer term sustainability? Solving this problem represents the greatest challenge for science and technology in the twenty-first century.

Our basic understanding and analysis of the sectoral and cross-sectoral issues articulated in the General Assembly's resolution 44/228 are founded upon international scientific knowledge. This already forms an integral part of the treatment of every sector covered in the various progress reports which also include the specific monitoring/research/training/institution building requirements for dealing with these environment and development issues. However, there are broader questions involving development and science that need special attention. For example, how can existing knowledge be applied and new knowledge generated to meet the needs of development? How can the scientific community be more effectively brought into the process? And how can priorities for scientific research be determined and facilitated?

2. THE CONTENT AND NATURE OF SCIENCE

2.1 The Content of Science

Science is conventionally divided into the natural sciences (biology, physics, chemistry, etc.), the health sciences (medicine, dentistry, public health, etc.), the engineering sciences (civil, chemical, nuclear, etc.) and the social sciences (economics, sociology, demography, political science, etc.).

These classical subdivisions into science disciplines are studied in the universities by faculties and departments. Historically, this system worked well but in recent years the boundaries between disciplines have become blurred; and in many cases, important contemporary research topics occur at interfaces between disciplines. In particular, the development-science nexus requires inputs from a wide range of sciences; and the inputs, and outputs,

must be formulated in ways that permit everybody involved to understand one another. To meet this need, numerous interdisciplinary environmental and natural resource institutes were established in the 1970s and 1980s. Similarly, many Governments created Departments of the Environment, the United Nations established UNEP, and ICSU created the Scientific Committee on Problems of the Environment (SCOPE). Many of these initiatives have been highly productive, and some new disciplines have emerged, e.g., environmental toxicology, environmental economics, risk assessment and environmental ethics. Nevertheless, communication problems between disciplines and with non-specialists still remain.

The crucial symbiotic relationship between science and society has still not been widely appreciated. Science can contribute to societal development but, in turn, society must nurture science. Scientific inquiry is often conducted purely for intellectual satisfaction as a fundamental manifestation of human culture. Much of modern development draws on the results of this activity. For this reason, basic research should be supported by the developed as well as developing countries. The growing commercialization of basic research could pose a barrier to the exchange of knowledge between scientists and thereby hurt scientific creativity and the use of science for enhancing our understanding of environmental and developmental issues. Moreover, there is greater need for mission-orientated or goal directed research, and in this report the main interest will be in those scientific activities that will help in "Promoting socio-economic development without damaging the environmental resource base over the long term".

2.2 Changing Social Responsibility and Ethics in Science

Science, although traditionally "practised for its own sake", has gradually become so important to humanity that ethical questions have steadily pushed their way to prominence, especially in the last 40 years. These issues relate to the social responsibilities of not only the practitioners of science but also, the users of its findings.

The methods employed by scientists to elucidate the structure and functioning of the universe commonly involve some degree of interference with nature. To avoid harm being done, scientific codes of practice have traditionally been developed which were regarded as not compromising the objective pursuit of a "value free" science. Thus, animal and human experiments are officially controlled and any excesses condemned by all civilized nations.

But these problems are minor compared with those arising from the ways in which society uses the results of science, and scientists knowingly acquiesce.

Using the results of science can create greater health, comfort, wealth and power. All these can be procured to benefit a much wider constituency in society, but may often be obtained without much consideration for unintended but harmful side-effects, which usually fall on the poorer, weaker or less influential groups. Despite the laws and conventions controlling the civil and military misuse of science and the large body of ethics in medicine, there are still many gaps which allow unacceptable practices worldwide. It is no wonder that science may be viewed with suspicion by the disadvantaged groups.

Should scientists work on a problem knowing that their findings are likely to be harmful or misused? And should they speak out when they see malpractice of which society at large is unaware? These old problems have been given a very serious, new twist by the growing realization that the products of science can be used in ways which may harm the environment more or less irreversibly, and this could mean harm to future development and hence, to future generations. And there are no codes of practice or ethical rules in force to protect the biosphere or our successors. Environmental scientists are the best able to calculate the risks of future harm although they may not always be the best placed to compute the societal costs. Such questions which involve decision-making under conditions of uncertainty are being encountered more and more. Just as the sustainability issue, squarely faced, forces us to look at the ethical issues of international and intergenerational equity, so the issue of uncertainty in environmental analyses makes such ethical questions as the "precautionary principle" matters of urgency, in order to avoid delays in making decisions.

In order to direct the global scientific effort more effectively towards the solution of environmental problems and the provision of guidance for sustainable development, the current processes of scientific inquiry need to be supported by a value-systems framework. Such a framework must be accorded international approval and receive acceptance from environmental scientists. This would make the work of the scientists much more usable by policy-makers who ultimately have to take the difficult environmental management decisions.

3. DEVELOPING A SCIENCE AGENDA 21

Developing and refining a long-term science agenda for environmentally sound and sustainable development is to become a major task for the scientific community, to be undertaken in close consultation with decision makers and planners in Governments and in the different economic sectors such as energy and transport, industry, and agriculture and forestry. New transdisciplinary and other types of approach to the large "systems" involved will be needed on a continuing basis.

3.1 Objectives and Goals

The objectives of Science Agenda 21 should aim at identifying the unknowns and uncertainties about major driving forces and perceived causes that are at the root of current major issues and concerns of environmentally sound and sustainable development. The research agenda is required to facilitate means and ways of addressing those issues properly and of building up a sound scientific basis for assessing the Earth's carrying capacity, ability to "assimilate" waste products, resistance to degradation, and resilience to environmental shocks.

Moreover, science for sustainable development needs to address major environment and development issues such as demographic pressures, unsustainable consumption patterns, poverty and sustainable development, atmospheric and ocean pollution, land degradation, deforestation, toxic chemicals and hazardous wastes, loss of biological diversity, and risk/benefit of biotechnology, etc.

Of paramount importance is to integrate the contributions of the natural, engineering and social sciences into the formulation of environment and development policy and the decision-making process and to provide guidance for planning and implementation of development programmes at national, regional and global levels.

3.2 Forming New Disciplinary Combinations

As the need to analyse and quantify the structure and functioning of larger, more complex systems has developed in recent years, there has been much success within the natural sciences in interdisciplinary research. However, the success rate has not been so favorable in the case of collaboration between the natural, engineering and social sciences in tackling problems of environment and development despite the growing need. Forming the new combinations required within and between the natural and social sciences is a matter of developing new processes of cooperation and partnerships, and features may not be realized until a common language of communication can be developed between very disparate specialisms. Meaningful communication requires four elements: a "larger" issue of common interest; an ability to speak clearly; the capacity to listen patiently; and a common language. Interdisciplinary cooperation requires the same four elements: a sharply focused definition of the problem to be solved; an ability to present knowledge in a form intelligible to individuals from other backgrounds; the capacity to make the conscious effort required to understand the concerns and contributions of others; and the realization that language, which may appear to be universal, in fact contains ambiguities and nuances depending on individual backgrounds.

This obstacle to fruitful interdisciplinary cooperation is exemplified in the case of the application of scientific and engineering knowledge to the control of communicable diseases. The classical dialogue, which used a classification of water-related diseases based on the nature and life cycle of the causative organisms (bacterium, virus, worm, etc.), failed to produce significant results. The situation was transformed when a new classification was introduced, based on the mode of dissemination of the disease (water-borne, water-washed, water-related vectors). Concentration on these differences in dissemination greatly facilitated both the discussion of the causative factors responsible for outbreaks and appropriate preventive and control measures. Again the development of "systems analysis" and modelling has enabled shared perceptions of the larger issues to emerge.

3.3 Components of the Science Agenda 21

Science Agenda 21 could include, but not be limited to the following components: (1) the natural sciences; (2) the engineering sciences; (3) the social sciences; (4) the health sciences; (5) the linkages between the natural and social sciences, particularly with respect to policy; and (6) traditional knowledge in environment and development. These six components could function at all levels: national, regional and global. It is also important to emphasize that the allocation of human, physical and financial resources needs to be divided in a balanced manner so as to cover all components.

As the underlying science programmes of the specific issues or sectors will be covered in each of the appropriate issue/sector documents, a general science agenda could deal with broader initiatives that cut across issues/sectors. A brief review of selected cross-sectoral programmes by some United Nations agencies and international non-governmental organizations is attached herewith as an Annex. This report is presented for the purpose of discussion and an integrated agenda (after the ICSU Conference, see Section 3.4) will be submitted to the next session of the Preparatory Committee in March 1992.

(1) Natural Sciences

The natural sciences can enlarge our understanding of the structure and functioning of the universe and its components.

- Long-term global research programmes for identifying the unknowns about major driving forces and conditioning factors:

  Stratosphere - Troposphere Interactions and the Biosphere (STIB);
  Land-Ocean Interactions in the Coastal Zone (LOICZ);
  Global Analysis, Interpretation and Modelling (GAIM);

- Ecological research programmes:

  Global Change and Ecological Complexity (GCEC);
  Biological diversity and ecological processes;
  Genetically engineered organisms and the environment;
  Sustainability of ecological systems, e.g. eco-agriculture and sustainable rural development, etc;

- Sustainable energy systems:

  Renewable energy resources including rural energy;
  High efficiency systems of fossil fuels;
  Alternative fuels including biofuels, hydrogen, etc.

(2) Engineering Sciences

The engineering sciences can provide structures, mechanisms and technologies useful to humanity.

Engineering for natural disaster reduction and land degradation control;

Development of new technologies involving low energy intensity;

New technology for pollution control and hazardous waste management;

Development of new biotechnology-based industrial technologies;

Efficiency improvements for the transmission and use of energy.

(3) Social Sciences

The social sciences can elucidate behavior and the conduct of social relations.

Environmental ethics;

Relationship between population trends, human development and the environment;

Environmental economics of global warming, ozone layer protection, biological diversity, ocean pollution, environmental health, etc;

Transition to a low-material, low energy consumption and low pollution economy;

Policy determinants of technological changes and environmentally sound actions.

(4) Health Sciences

The health sciences can clarify in greater depth the relationship between environmental conditions and human health.

Risk assessment of new and unknown environmental factors (non-ionizing radiation, new chemicals, new technologies for food production and processing);

Environmental epidemiology and environmental impact assessment;

Forecasting of health impacts of development policies and projects;

Public understanding of environmental risks (risk communication) and community action in protecting environmental health.

(5) Interactions Between the Natural Sciences and the Social Sciences

Policy-making with respect to long-term environment/development issues involves: (1) large space scales, requiring a global perspective, right down to small scales, requiring a local perspective; (2) increasing uncertainty as time is extended into the future; (3) transsectoral interactions and feedbacks. Energy consumption, agriculture, population, urbanization, health and a great many other factors, including human value systems, will change over time, so that an analysis of the effects of climate change on a single sector is interesting but incomplete. A main research agenda item is therefore to develop methods for widening the scope of such research studies.

Environmental impact assessment has evolved in many positive ways over the last 20 years. It now needs to take the next step forward as an instrument for assessing, and discussing publically, proposals to introduce new technologies and public policies.

Recent ecological literature is rich with ideas of uncertainty and chaos theory. Ecosystems evolve to meet changing environmental conditions (the idea of ecosystem integrity) and efforts to preserve them in their present state are likely to fail. This thinking should be introduced into development planning and programming and project appraisal, where externalities are often assumed to remain constant, or to change very slowly.

There is a great need to establish priorities amongst a range of environment and development issues. Current methods of policy-making are generally rather elitist, and there is a need to develop new methods which involve participation and consensus building, including those who would be affected by the proposed policies. Some of the newer approaches such as policy exercises and backcasting are promising. Much more work needs to be encouraged in this field. There is a considerable knowledge gap in the field of population-resources-development-environment interactions and closing this gap should be one of the priority areas for research and action.

(6) Traditional Environmental Knowledge in the Development Process

Traditional communities possess unique knowledge of their environment including information on plants, animals, land and water resources, and ways and methods of their use. These communities, including tribal populations and/or spatially isolated groups usually live in socially, ecologically and geographically marginal situations. Consequently, they are often threatened by massive unexpected incursions into their habitats or by major development projects which tend to displace themselves and sometimes even to destroy them along with their habitats. Destruction of their habitats often takes place also. A constructive use of traditional knowledge by itself and in combination with modern knowledge could open new options for sustainable development in many areas.

In the interest of these communities and of society at large, the knowledge that local people have acquired over many generations should be appreciated, recorded, analyzed and used; this knowledge needs to be treated as an intellectual property. Consequently, efforts could be made to ensure that any profits, financial or otherwise, which may result are not appropriated by outside interests. Appropriate mechanisms are needed to channel these profits back to the communities involved, but at the same time avoiding the disruptive effects of the overwhelming windfall gains.

3.4 International Conference on an Agenda of Science for Environment and Development (ASCEND 21)

In order to provide an input to the development of Science Agenda 21, ICSU, in cooperation with TWAS and in partnership with several other non-governmental organizations, is convening the ASCEND 21 Conference in Vienna in November 1991. The Conference will seek to bring together the understanding and judgement of the world's scientific community on issues of highest priority for the future of environment and development. The Conference will cover the issues, specified in Section 3.1, which were discussed at a meeting of the authors of ASCEND papers in July 1991. The UNCED Secretariat expects that the major outputs of ASCEND 21 will serve a valuable contribution to the UNCED preparatory process in this regard.

4. COMMUNICATING THE RESULTS

4.1. The Communication Issue

Scientists are skilled at communicating with their colleagues through publications and professional meetings, an approach which is familiar, efficient and accessible. Traditionally, scientists have never felt the need for anything that went beyond this. However, nowadays, in the era of more socially relevant science, this has had the unfortunate and largely unintended consequence of limiting scientists' influence to the confines of their peers. Also, the carefully cultivated objectivity of scientific inquiry has produced a scientific culture collectively reluctant to draw policy conclusions and give advice.

Today, scientists are being called upon more and more to interpret their results to political decision-makers, governmental administrators, legislators, leaders in business, industry and religion, and women and children. To communicate means first to identify the likely audience group, and, secondly, designing the most effective way of reaching each such group, because this varies with the group involved. This issue is in itself a suitable subject for systematic study. There is a need for scientific translators, communicators and educators, whose training merits attention.

With the increasing collaboration taking place amongst disciplines, publication of multi-authored scientific syntheses is becoming a vehicle for communication between disciplines. Funding for such endeavors can usually be found; however, proposals to produce popular versions of these syntheses, written by competent science writers, are almost always unsuccessful.

Popular magazine articles, film, video and radio are appropriate for particular audiences. School curricula and even teaching methods warrant attention. Graphic and other visual packaging of results will make science more intelligible to more people. In this connection, some people can be most effectively influenced through traditional art forms-theater, painting, literature, song and dance. These forms are eschewed by "modern" scientists but are used effectively in traditional cultures.

Finally, various non-specialist groups are interested in environment/development data. State-of-the-environment and other reports need to be mindful of these special needs. For example, the acidity of a lake is not of much interest to citizens' groups; rather it is the number of species of fish that have gone extinct in that lake. As another illustration, there are sophisticated technologies including satellite-based techniques, for measuring wind, vegetative cover, precipitation, and other variables.

In summary, effective communication requires:

Packaging information in appropriate formats and making it accessible to the various people interested;

Undertaking assessments and analyses guided by the requirements of these constituencies;

Processing data in formats and systems determined in part by this needs-driven approach;

Collecting data of type, scale, frequency and reliability specified by the logic of user needs;

Training of scientific communicators, translators and educators;

Securing of funds to permit preparation by science writers of popular versions of technical syntheses of important topics in the environment/development field.

4.2 The Information Explosion: A Major Problem for Developing Countries

Science is moving forward very quickly, which brings both benefits and risks with respect to the development process. More than 2 million papers are published in science and medicine every year, and the number is increasing. At the same time, supporting technical facilities (computer capabilities, telecommunications, remote sensing from satellites, etc.) have evolved remarkably in recent years. Although of great benefit to industrialized nations, this has disadvantaged scientists in the developing countries, whose libraries and laboratories are falling farther and farther behind those in the developed countries. Several bodies are combining forces in efforts to solve these problems. ICSU, along with TWAS, UNESCO, the American Association for the Advancement of Science (AAAS) have recently begun a serious study on how to reduce the North-South inequities in the availability of scientific information.

A related problem concerns the selection, analysis and synthesis of the published literature. Electronic information systems will soon be able to transmit collections of journal articles almost instantaneously to almost anywhere in the world while teleconferencing is also becoming a global reality. However, these tools are of little use to a scientist working "on the ground" in a remote part of the world, who needs synthesized information specifically related to the environmental riddles with which he is struggling. In this connection, many of the United Nations bodies publish excellent technical working papers of immediate relevance in developing countries. But the distribution system is far from perfect in many cases, particularly when a topic is in a cross-sectoral research area. An efficient information clearing house would require national, regional and global funding commitments. Some international agencies are already funding information dissemination initiatives at the national and regional levels but the efforts so far have fallen short of the considerable demand in developing countries. In this connection, developing countries could play a major role in designing a clearing-house. Without the availability of relevant information and its dissemination to scientists working "on the ground", these countries will not develop.

5. SCIENCE EDUCATION

5.1 The Broad Issue of the Role of Science in a Country

In the contemporary world, a country's comparative advantage often depends greatly on the number and quality of its scientists and scientific institutions. It also depends on how science feeds into societal and technological development (R & D). For science to be able to play this role, it needs to be embedded in a society at the highest possible level of general education. Science and technology must be given a special focus not only in general education but also in decision-making processes at all levels. A political and cultural atmosphere conducive to scientific inquiry and intellectual freedom is also important.

In summary, one of the fundamental prerequisites for development in general, and sustainable development in particular, is a "scientific culture" and a full and continuing contribution of science to national, regional and global policies and agendas.

5.2 Linkages between Education and Research Institutes and Development

Universities, research institutions and development agencies constitute the main scientific/technological development system of a nation. However, linkages among these groups are often weak, particularly in developing countries. In developing countries, a critical mass for effective teaching, research, technology generation and transfer, policy formulation and development is usually lacking. Sometimes the total resources available for environment/development studies are sufficient but they are not deployed in the most effective way. In many developing countries, the universities are not turning out graduates adequately trained for the tasks that they are expected to undertake. This is particularly true in the case of environment/development matters. University curricula often lag behind the latest scientific findings and development trends, leading to a critical shortage of specialists in environment management and related fields. Methods of improving the current situation should be considered by assisting universities to develop policies, infrastructures and programmes to produce environmentally literate specialists with an interdisciplinary outlook in the natural and social sciences. Some of the ideas that might help include:

Appointment and promotion criteria could be changed to reward interdisciplinary work on environment/development issues;

Interdisciplinary centres of excellence might be established within universities - to promote education, research and policy development;

Additional interdisciplinary training in environment/development issues needs to be provided to existing academic staff;

Professionals from government and private-sector laboratories are better to be cross-appointed to the universities, e.g., for joint supervision of graduate student's research;

More North-South linkages and cooperation should be developed between universities, science libraries, national institutes and other appropriate bodies.

5.3 Environmental and developmental education

Environmental and developmental education will need to become an integral part of science education and of basic education for all. At the international level the UNESCO/UNEP International Environmental Education Programme (IEEP) has been active since 1975 in curriculum development, teacher training, networking and promotion of information exchange. The main emphasis for the future will need to be in the production of innovative educational materials, on training of specialized educational planners at country level and on the environment and development links as a basis for informed action involving the stakeholders of sustainable development (e.g. educators, industrialists, scientists, Governments). Special attention needs to be paid to ensuring that the best available scientific information is fed into the materials and activities of environmental and developmental education. Major scientific endeavors should specifically address this question of how best to pass on results to those responsible for environmental and developmental education.

6. SCIENTIFIC CAPACITY BUILDING

6.1 National Institutional Needs

The ability of a country or state to use science and technology for environmentally sound and sustainable development is determined to a large extent by its endogenous capacity. The cost of developing such endogenous capacity will often be less than the cost of expatriate expertise. Therefore, it is imperative for developing countries to build up their own capacity: (1) to study their ecological systems and manage them better; (2) to promote the development and diffusion of environmentally sound technologies; and (3) to meet the regional and global challenges. In order to assist them in building up this national scientific capacity, the international support for respective training programmes offered within and outside the United Nations system could be stepped up considerably. National institutions have a responsibility to enhance scientific cooperation with other relevant national counterparts in regional and international programmes and thus form a close link between policy and scientific needs.

Among other recommendations, an efficient information clearing-house is required to be established timely and developed successfully so that information packages covering the proper utilization of national resources, energy, health and sanitation should be available. Necessary technical, infrastructural and manpower training supports need to be provided to developing countries to strengthen their capacity in informatics.

6.2 Regional Institutional Needs

Higher level institutions can conduct basic and applied research through bilateral and multilateral support. Regional institutions would facilitate the scientific and technological needs in developing countries at the regional

level. Such institutions would be able to link and coordinate regional programmes through technical and financial assistance that national institutions might be unable to secure effectively. It would then be easier for regional institutions to communicate the successes or failures of scientific research.

Regional institutions would be more effective in coordinating academic needs in those issues or sectors as specified in Section 3.1 that are regional and global in scope. They might also be able to encourage active involvement of less developed countries in regional programmes.

Regional research networks have been established for a number of environment and development issues. Most of them are promoted within the scientific programmes of UNESCO, WMO, FAO, WHO, UNEP, etc. However, due to lack of financial resources many of these research networks do not function fully satisfactorily. Moreover, a number of regional research centres dealing with the environment, natural resources management and related development issues have been established or their establishment is in advanced stage. Among them, are the International Centre for Integrated Mountain Development (ICIMOD) in the Hindu-Kush Himalayas region, the Centre for Environment and Development for the Arab Region and Europe (CEDARE) sponsored by UNDP, in cooperation with UNESCO and other United Nations organizations, and a recent initiative, known as the System for Analysis, Research and Training (START) created within the IGBP.

The regional development banks and other principal regional institutions have been encouraged to join in developing proposals for the establishment in each region of a sustainable development and technology support system (SDTSS). The establishment of such networks is the principal purpose of the UNDP's Sustainable Development Network's (SDN) initiative (please see A/CONF.151/PC/53). The concept of a regional research center (RRC) has potential merit and is well worthwhile for study and development. The overarching function of the RRC is the core of the SDTSS or SDN under which RRC plays a decisive role in conducting interdisciplinary and/or multidisciplinary research; promoting the development and diffusion of environmentally sound technologies; organizing science education and technical/managerial training; establishing and maintaining an information system, and coordinating scientific cooperation among all nations in the region.

Certain aspects of capacity building at national and regional level may need to be supplemented at a global level. This question will be discussed at ASCEND 21 in November 1991.

7. CONCLUSION

The basic facilitating means and mechanisms that can give operational reality to the process of environmentally sound and sustainable development, as identified in the General Assembly's resolution 44/228, will need to include a comprehensive package of scientific backstopping activities, including improved application of knowledge, generation of new knowledge, scientific capacity building, environmental and socio-economic monitoring,

assessment and information exchange. As presented in this Progress Report, work is in progress to better define the role and needs of science for sustainable development. The UNCED Secretariat will submit the results of this work to the next session of the Preparatory Committee together with more elaborate proposals concerning potential areas for action related to the programmes of Science Agenda 21 and scientific capacity building to be included in Agenda 21. At this session the Preparatory Committee may wish to discuss the following preliminary conclusions concerning strengthening the contribution of science to environment and development. In this way the Preparatory Committee would guide the continuation of the work organized by the Secretariat in this field.

1. Science for sustainable development needs to address both systemic changes that operate globally through the major systems of the geosphere-biosphere (e.g. climate change) and cumulative changes that represent the global accumulation of localized changes (e.g. desertification and land degradation). There is a need to strengthen and provide additional support to innovative collaborative studies involving both the natural and the social sciences on global change issues, on issues relating to ecological and socio-economic linkages and harmonization, and on adapting scientific knowledge by developing countries for their own betterment.

2. The Earth system is threatened with unprecented environmental changes over the next 50 years, which will seriously impair the sustainability of human development unless major corrective actions are taken. As a basis for such actions, it is imperative to carry out the interdisciplinary research necessary to understand better the total Earth system. Thus the ongoing and planned global change research programmes should continue to have high priority on the international research agenda.

3. Whereas there are observational networks for many of the environmental indicators relating to global changes, no similar monitoring programmes in the social sciences with respect to indicators of sustainable development (global or regional). Designing such programmes may need to be given high priority.

4. Scientific analyses of the issues involved with environment and development are closely linked in many important ways with economic, legal, institutional and particularly ethical consideration. This is especially the case when the analysis is being carried out for management purposes. In order to ensure global sustainability, scientists and others need to develop principles which would focus on how decisions are to be made under conditions of uncertainty about potential risks to regional and global ecosystems.

5. The knowledge that traditional communities have acquired over many generations should be appreciated, recorded, analysed and used, treating them as intellectual property. Some of the principles and methods central to traditional knowledge may contribute significantly to sustainable development at all levels. A project on compilation analysis and codification of information on traditional practices could be initiated.

6. Endogenous scientific research capacity in the environment and development field is necessary to be strengthened in developing countries. At the same time, there is a need for higher level and more sustained funding for international scientific bodies - e.g. ICSU, IUCN, ISSC, etc.

7. Agreements and conventions should be based on sound scientific knowledge and analysis. Developed and developing countries alike need to participate as full partners in reaching these agreements. Scientific resources are necessary to be deployed, particularly in developing countries, to this end. Without such resources it will be impossible to achieve these goals.

8. The recent scientific publication explosion is greatly increasing the inequities between scientists in developing and developed countries. Scientists in developing countries are greatly in need of syntheses of the most recent research studies in the field of environment/development. Programmes could be established: (1) to support the publication and improved distribution of update and authoritative reviews of selected topics in this field; and (2) an action plan might be developed that would provide the basis for regional information clearing houses that could provide technical assistance with respect to environment/development issues.

9. It is important that the role of science in human affairs be more widely known and better understood, both by decision makers who help determine public policy, and by the general public. There is a special need for a new commitment worldwide to scientific education, and to the creation of scientific literacy among the global citizenry.

10. Technology transfer will be an important consideration to help bridging the gap between the scientific capabilities of developing and developed countries. A series of measures should be taken in order to promote the development and diffusion of environmentally sound technologies, and to ensure that all countries, and particularly developing countries, have access to them on an equitable and affordable basis (see A/CONF.151/PC/53).

ANNEX

Review of Selected Major Science Programmes by Some United Nations Agencies and International Non-Governmental Organizations

Some of the major United Nations agency and NGO programmes whose outputs contribute to the resolution of environment/development issues are described in the following sections. In general, these programmes are cross-sectoral, and quite naturally have resulted in increased collaboration amongst intergovernmental and non-governmental bodies. Sometimes these programmes have not had as much financial support as they could wisely use (other activities may have had higher priority), but it is hoped that the UNCED process will provide a catalyst for further support, and a re-direction of current resources in some cases.

1. SELECTED MAJOR CROSS-SECTORAL PROGRAMMES BY SOME UNITED NATIONS AGENCIES

1.1 The United Nations Educational, Scientific and Cultural Organization (UNESCO)

UNESCO, at the crossroads of education, science, culture and communication, offers a special institutional setting for dealing with the multidisciplinary facets of science in relation to the long-term problems of development.

(1) The Man and the Biosphere (MAB) Programme was launched in 1971 to encourage interdisciplinary research, demonstration and training in natural resource management. MAB thus contributes not only to better understanding of the many factors that affect environment-development interactions but to a greater involvement of scientists in deciding how resources can be used more wisely. As it enters its third decade, MAB is focusing on new approaches for facilitating sustainable development. Emphasis is placed on problem-oriented research, involving both natural and social sciences. The ecosystem approach is used throughout, and effective collaboration is with ICSU bodies.

(2) The Intergovernmental Oceanographic Commission (IOC) plays a leading role in a strengthened and effective ocean partnership among UNESCO and IOC Member States and the United Nations System, stressing interdisciplinary and cross-sectoral approaches, mainly through:

Contributing to better understanding of the ocean and coastal zone environments, their state of health, biodiversity, role in climate and global change;

Collaborating with UNEP and WMO in pilot activities for monitoring coastal and near-shore phenomena related to global climate change and enhanced societal use of coastline regions;

Contributing to training, education and mutual assistance in marine sciences.

(3) The International Hydrological Program (IHP) is in its fourth phase (1990-95) and has a main theme Hydrology and Water Resources for Sustainable Development in a Changing Environment. With increasing freshwater consumption, and declining replenishment (in a warmer Earth), water supply is likely to be the major factor limiting development in many parts of the world in coming decades.

Activities within UNESCO are also of considerable relevance to UNCED goals.

One of the main endeavors is the organization of an International Forum on Sustainable Development;

A joint programme is being undertaken with the International Institute for Applied Systems Analysis (IIASA) addressing the specific attributes of environmental negotiation processes, based on recent experiences drawn from river and water-right negotiations.

Finally, mention should be made of UNESCO capabilities with respect to the science-education interface, which is a crucial component in environment-development issues.

1.2 The United Nations Center for Science and Technology for Development (UNCSTD)

UNCSTD is engaged in the substantive theme: "ways and means of ensuring the participation of developing countries in international cooperation for research on and development of environmentally sound technologies, and the rapid and effective transfer of such technologies to the developing countries".

Its major current activities are:

(1) National policy dialogues. The Projects will be implemented through a number of studies on subjects of priority concern to selected developing countries supported by, in principle, three rounds of dialogues in each participating country discussing the results of their studies in the light of identifying a concrete set of initiatives.

(2) A register of research. UNCSTD and the United Nations University (UNU) are developing a database covering a United Nations systemwide inventory of research in progress for the use of the United Nations system in particular and the research community in general. This will facilitate the exchange of information among researchers so as to, inter alia, promote research cooperation and also avoid unnecessary duplication of efforts.

(3) Technology assessment. The initiative forms the basis for the advance technology assessment system bulletin entitled "Environmentally Sound Technology Assessment (ESTA)". The analysis is to focus on policy options with regard to transfer and management of environmentally sound technologies in developing countries as well as research cooperation on such technologies between developed and developing countries.

1.3 The WHO/FAO/UNEP Panel of Experts on Environmental Management of Vector Control (PEEM)

There are often dramatic increases in easily preventable vector-borne diseases such as malaria and schistosomiasis, following the introduction of irrigation, hydropower development and other water-related development projects in many parts of the tropics, which then require control measures with pesticides, drugs and/or vaccines. Arising from a concern about this serious problem, PEEM was established in 1981 as an advisory and policy-making body for WHO, FAO and UNEP. Its objectives are:

To promote collaboration among the different public sectors and international and national agencies concerned with health, water development and environmental protection;

To foster intersectoral collaboration in natural resource development, agriculture and health and in the application of environmental management techniques for the control of disease vectors and for the protection of human health and the environment;

To help solve vector-related scientific problems of water resources management;

To provide an institutional framework for collaboration in the application of environmental management measures for vector control:
(1) at all levels - international, national and non-governmental;
(2) between all involved disciplines and communities - health, agriculture, environment, development, science and technology, management, social science, political science and the donor community.

Since its inception, PEEM has been active through a network of 39 members and 10 collaborating centres world-wide in the promotion of multidisciplinary research, the development of curricula for the training of engineers and agricultural scientists in the principles of environmental management for vector control, the production of guidelines and training aids and the promotion of a continuous dialogue between sectors.

1.4 The UNDP/World Bank/WHO Special programme for Resea and Training in Tropical Diseases (TDR).

TDR was established in 1975 with two objectives:

To develop new methods of preventing, diagnosing and treating selected tropical diseases, methods that would be applicable, acceptable and affordable by developing countries, require minimal skills or supervision and be readily integrated into the health services of these countries;

To strengthen, through training in biomedical and social sciences and through support to institutions, the capability of developing endemic countries to undertake the research required to develop these new disease control technologies.

TDR's activities are targeted towards six disease groups: malaria, schistosomiasis, the filariases (including onchocerciasis or river blindness), the trypanosomiases (both African sleeping sickness and the American form, Chagas Disease), the leishmaniases and leprosy.

2. SELECTED MAJOR CROSS-SECTORAL PROGRAMMES BY SOME INTERNATIONAL NGOs

2.1 The International Council of Scientific Unions (ICSU)

ICSU was created in 1931 to promote international scientific activity in the different branches of science and their application and often cooperates with other international organizations, from the United Nations or the NGO sector, in carrying out its international programmes. The global environment has been the focus of several undertakings by ICSU over the past 20 years. Such studies have a common objective of strengthening the scientific basis for the prediction of impacts and the creation of policy options for prevention, mitigation and adaptation.

(1) The Scientific Committee on Problems of the Environment (SCOPE)

SCOPE is charged with assembling, reviewing and assessing the information on man-made environmental changes in order to synthesize the status of current knowledge and identify gaps and research priorities. SCOPE draws on a global network of specialists.

SCOPE focuses on major international scientific problems, selecting those that are both interdisciplinary and tractable. An example is the landmark SCOPE Study on the Environmental Consequences of Nuclear War. At the present time, SCOPE is concentrating on four interlocking themes: Sustainable Development; Global Change and Ecosystems; Health and Ecotoxicology; and Biogeochemical Cycles.

(2) The ICSU-WMO-IOC World Climate Research Programme (WCRP)

WCRP is focused on the physical aspects of the climate system, which is itself a sub-set of the Earth system. WCRP thus deals in particular with the atmosphere, the ocean, the terrestrial biosphere, ice and the hydrological cycle.

WCRP is divided into three Streams:

Stream 1, which is essentially extended-range forecasting;

Stream 2, which deals with inter-annual variations, and is aimed at taking advantage of predictability in the ocean arising from its "memory" and from understanding its dynamics;

Stream 3, which is aimed at understanding the sensitivity of the climate system to changes in external forcing.

The principal thrusts of WCRP are:

TOGA: the Tropical Ocean Global Atmosphere Study, which is essentially a Stream 2 activity;

WOCE: the World Ocean Circulation Experiment, directed toward better understanding of the behavior of the ocean;

GEWEX: the Global Energy and Water-cycle Experiment, which is directed toward gaining a better understanding of the hydrological cycle.

(3) The International Geosphere-Biosphere Programme (IGBP)

The IGBP was established by ICSU in 1986, to describe and understand the interacting physical, chemical and biological processes that regulate the total Earth system . While not seeking to be comprehensive, it concentrates on a limited number of focussed research projects, treating important aspects of the Earth system which are:

(a) The Global Atmospheric Chemistry Project (IGAC)

To develop a fundamental understanding of the processes that determine the chemical composition of the atmosphere;

To understand the interactions between atmospheric chemical composition and biospheric and climatic processes;

To predict the impact of natural and anthropogenic forcing on the chemical composition of the atmosphere.

(b) The Joint Global Ocean Flux Study (JGOFS)

To determine and understand on a global scale the processes controlling the time-varying fluxes of carbon and associated biogenic elements in the ocean, and to evaluate the related exchanges with the atmosphere, sea floor and continental boundaries;

To develop a capability to predict on a global scale the response of oceanic biogeochemical processes to anthropogenic perturbations, in particular those related to climate change.

(c) The Biospheric Aspects of the Hydrological Cycle (BAHC), which is planned in cooperation with GEWEX of WCRP. Its objective is to gain an understanding of the interactions between vegetation, land cover and the hydrological cycle.

(d) The Global Change and Terrestrial Ecosystems Project (GCTE), which is designed to develop a capability to predict the effects of changes in climate, atmospheric carbon dioxide and land use on terrestrial ecosystems, and how these effects can lead to feedbacks to the physical climate system.

(e) Past Global Changes (PAGES), which tries to draw from the past, inferences which have implications for the present and future. Its main objective is to construct the detailed history of climatic and environmental change for the entire globe for the last 2,000 years, and through a full glacial cycle, in order to improve our understanding of the natural processes that involve global climatic change.

(f) IGBP Office of Data and Information Systems (IGBP-DIS), which has been established to deal with the vast quantities of data that modern techniques make possible, and to provide methods to collate these data in various ways as required by different users.

The work of both IGBP and WCRP has been recognized by a resolution of the United Nations General Assembly in December 1989 and by the Intergovernmental Panel on Climate Change in 1990.

In addition to the work of SCOPE, IGBP and WCRP, at least 20 other ICSU bodies are undertaking activities relevant to the environment-development issue.

2.2 The International Social Science Council (ISSC)

ISSC has appointed a Standing Committee on Human Dimensions of Global Environmental Change (HDGEC) which will develop and coordinate scientific interdisciplinary on behalf of social sciences. It sets out to consider human activities both as they contribute to and as they are affected by global environmental change. These activities are driven by three factors: the large and rapidly increasing population and its distribution around the globe; human needs and expectations; and the cultural, social, economic and political structures and institutions that shape and mediate their behavior.

The following seven research topics are being undertaken under HDGEC:

Social dimension of resource use;

Perceptions and assessment of global environmental conditions and change;

Impacts of local, national and international, social, economic and political structures and institutions;

Land use;

Energy production and consumption;

Industrial growth;

Environmental security and sustainable development.

The Committee has established its permanent secretariat. First scientific symposium on HDGEC took place in 1990 and several working groups have already been appointed. In addition, other organizations such as the International Federation of Institutes for Advanced Studies (IFIAS), UNU and UNESCO have also initiated studies on human dimensions of global change.

ISSC is also involved in a major research project on Social Dimensions of Environmental Disorder in Amazonia. A liaison with the project is provided by the newly created (1990) ISSC Committee on Environmental and Development. Various ISSC bodies have initiated their own programmes of research on environment-development issues.

2.3 The International Union for Conservation of Nature and Natural Resources (IUCN)

IUCN's objectives are (1) to secure the conservation of nature, and especially of biological diversity; (2) to ensure that the earth's natural resources are used in a wise, equitable and sustainable way; and (3) to guide the development of human communities towards ways of life that are both of good quality and in enduring harmony with other components of the biosphere. The World Conservation Strategy (WCS) of 1980 (prepared in cooperation with UNEP and WWF) was a forerunner of the Brundtland Commission and a follow-up based on 10 years experience of implementing the WCS called Caring for the Earth: a Strategy for Sustainability, was launched in 1991.

IUCN's major programmes are:

Conservation of biological diversity;

Application of ecological science to conservation;

Habitat and protected area management;

Application of social science and demographics to conservation;

Formulation and application of conservation strategies, environmental law, education and training within the context of national and international conservation and development activities.

2.4 The Third World Academy of Sciences (TWAS)

TWAS was established in 1983 by distinguished scholars from the South. Among the major programmes of the Academy is scientific capacity building in the South in environmental sciences of major concern to developing countries, such as deforestation, desertification, floods, earthquakes, energy, and environmental pollution. For this purpose, TWAS is assisting a number of developing countries to establish a Network of Research and Training Centres of Excellence in these sciences. A Commission of Heads of States/Governments in the South has been established to follow through the institution of this important Network. In addition, the Third World Network of Scientific Organizations (TWNSO) has recently instituted a Committee on Environmental Hazards and Global Change whose purpose is to promote joint action by concerned institutions in the South in environmental problems of common interest.

2.5 The International Institute for Applied Systems Analysis (IIASA)

IIASA is a scientific research organization, created in 1972 to develop, disseminate, and apply the tools of systems analysis in relation to policy issues having transnational dimensions or interest. The Institute aims not only to advance the knowledge in the particular research fields, but also to inform decision-makers, through applied methodologies and advice.

IIASA's major interdisciplinary research programmes include:

Environmental changes - both global and regional;

Population development and impacts;

Economic transitions in formerly centrally-planned economies;

Methodological approaches to complex problems.

IIASA has been commissioned to provide scientific support to the UNCED Secretariat - especially as regards how systems analytical approaches can be used to synthesize information on environment and development interactions and provide more holistic understanding of key variables and linkages.

UNITED
NATIONS

A

General Assembly

Distr.
GENERAL

A/CONF.151/PC/53
10 July 1991

Original: ENGLISH

PREPARATORY COMMITTEE FOR THE UNITED NATIONS
CONFERENCE ON ENVIRONMENT AND DEVELOPMENT
Third session
Geneva, 12 August - 4 September 1991
Plenary Session
Item 2 C of the provisional agenda

REPORT ON TRANSFER OF TECHNOLOGY

Report of the Secretary-General of the Conference

I. Introduction

1. At its second substantive session, the Preparatory Committee requested the Secretary-General of the United Nations Conference on Environment and Development to continue to develop reports on cross-sectoral issues for discussion at its third session, taking into account General Assembly resolution 44/228 and relevant decisions of the Preparatory Committee, the views expressed in the discussion and the conclusions of the regional preparatory conferences.

2. Also, in General Assembly resolution A/45/210, it was stated that "The General Assembly requests the Secretary-General of the United Nations Conference on Environment and Development to consult the Secretary-General of the United Nations Conference on Trade and Development and other relevant United Nations organs, organizations and programmes in preparing the report on transfer of technologies requested in decision 1/8 of the first substantive session of the Preparatory Committee of UNCED, including, inter alia, the obstacles on both the importing and exporting sides that impede the transfer of environmentally sound technologies."

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3. In document A/CONF.151/PC/17, a number of issues pertaining to the transfer of environmentally sound technologies were discussed including current activities and work process.

4. In further developing the report, the UNCED Secretariat is working in close collaboration with the relevant UN agencies including the United Nations Conference on Trade and Development, the United Nations Centre for Science and Technology for Development, the United Nations Centre on Transnational Corporations, the United Nations Educational, Scientific and Cultural Organization, United Nations Environment Programme, the United Nations Development Programme, the United Nations Industrial Development Organization, the World Intellectual Property Organization, the World Bank and the General Agreement on Tariffs and Trade. The work has also received valuable support from the International Council of Scientific Unions, as well as the Business Council for Sustainable Development, as well as from members of the Working Party on Transfer of Environmentally Sound Technologies.

5. The UNCED Secretariat commissioned papers on environmental management and technology transfer in some developing countries including Brazil, China and Thailand. The papers addressed case studies in selected areas focusing on the issues of locally developed technology, technological and financial impediments faced in developing countries for sound environmental management and public experiences and proposals.

6. The study for Brazil covered the following four cases:

a. Environmental Issues and Riocell's Technological Strategy (paper and pulp sector);

b. Environmental Management and Technologies Development: CESP case studies (hydroelectricity generation sector);

c. Industrial Pollution in Cubatao (chemicals and steelmaking);

d. Corporate Strategy, Environmental Management and Technology Transfer: the CVRD Case Study (mining).

7. The study for China focused on coal combustion technology and pollution control. It included four case studies of:

a. Development of Circulating Fluidized Bed Combustion (CFBC) in China,

b. District heating and cogeneration system,

c. Coal Briquetting Technique, and

d. Coal Slurry Technique.

8. The study for Thailand is based on Thailand's experience in environmental monitoring research and training. The study relied heavily on the experience gained resulting from the establishment of the Environmental Research and Training Centre (ERTC).

9. Based on these three studies as well as reports from the United Kingdom. Government, the Government of Japan and the Business Council for Sustainable Development, and United Nations agencies, a Workshop on Transfer of Environmentally Sound Technologies was organized by the UNCED Secretariat in response to the decision 1/8(g) of the first Preparatory Committee meeting. The Workshop, held on 3 and 4 June, reviewed and analysed case studies and discussed general lessons to be drawn from these studies. This report takes into account the findings of these case studies.

The Issues

10. The discussion of the transfer of environmentally sound technologies, which is a specialized discussion within the long-standing broader debates on the transfer of technologies to developing countries, has to take into account the general prospects of the international flow of technology. In contrast to its rapid expansion in the 1960s and 1970s, the international flow of technology levelled off or even declined during the first half of the 1980s. 1/ prospects for technology transfer, technological development and economic growth in the developing countries in the 1990s depend not only on domestic but also increasingly on external forces. A review of trends in technology flows in the second half of the 1980s reveals continued growth in the relative importance of capital goods trade and foreign direct investment among developed market-economy countries, an acceleration of such flows to a small number of countries in developing Asia and only modest improvement compared with the first half of the decade in their rate of growth in real terms to the majority of developing countries. Adverse financial constraints have outweighed the effects of favourable legislation in the attempt to attract foreign investment and technology and have contributed to a growing inability of many developing countries to keep up with technological developments that will be required in order to maintain or achieve international competitiveness.

11. A supportive international economic and policy environment for promoting technology transfer and building technological capacities in developing countries has to be pursued. This could be based on a number of elements including easing the adverse effects of financial and balance-of-payments constraints, and taking full account of the developmental, trade and technological objectives of developing countries in resolving of outstanding international trade policy issues/particularly in areas such as intellectual property, and service and investment measures. Also, there is a need to further explore initiatives for stimulating technological cooperation, such as a new look at mechanisms in developed countries for encouraging technology transfer to developing countries using tax incentives.

12. A major challenge for the world community in the 1990s and beyond is how to elaborate and implement a strategy for sustainable development. Transfer and development of technology is an essential component of a successful strategy of sustainable development. Use of environmentally sounder technologies - whether imported or developed locally - can contribute significantly to raising the productivity and sustainability of resources in such areas as agricultural production, renewable energy generation and pollution control.

13. Although some forms of environmentally sound technologies are available, a massive effort will be necessary to develop and to bring to the market technologies that have the potential to slow down or even reverse the trend of environmental degradation in the atmosphere, biosphere and geosphere without reducing or delaying economic growth. Of special importance are measures required to make such technologies available to developing countries under conditions that are fair and affordable and to improve their capabilities to develop and apply them.

14. The environmental soundness of technologies is a relative rather than absolute term depending on technical and economic conditions as well as the levels of environmental standards. Though an absolute definition is not possible, environmentally sound technologies are usually less polluting, less energy and resource intensive, use renewable resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies they replace.

15. Environmentally sound technologies are not just individual technologies but total systems, which include procedures, processes, products and services as well as equipment. This implies that when discussing transfer of technologies, human resource development and local capacity building aspects of technology options should also be addressed.

16. As many of these technologies are strongly science-based and also more costly, particularly because of a relatively high share of investment for scientific research and technological development, it is important to identify and establish creative ways and mechanisms of international research and technology cooperation. Of special importance are measures required to transfer environmentally sound technologies to developing countries under conditions that are fair and affordable.

17. Transfer and development of technology could better be achieved through a long-term partnership between suppliers and users of technology. A long-term partnership in technology cooperation necessarily emphasizes systematic training over a period of time. Also, many suppliers, who are not fully organized for technology transfer or cooperation could be better organized through this process.

18. Effective transfer of technology would include support for the further development of the scientific, technological, professional and related institutional capacities which developing countries will require to enable them to make intelligent technology choices based on technology assessment, to properly apply and manage technologies and to improve upon existing technologies and adapt them to their own development needs and priorities.

19. Technology transfer should not only be environmentally sound, but also benign for women and children. Such technology should build on indigenous technology and knowledge, and make use of locally available material. Environmentally sound and equitable methods of production and species preservation should be promoted.

20. Women must have access to and control over gender-differentiated and appropriate technologies to improve the quality of life for themselves and their children, and to enhance their ability to continue primary roles as resource managers, caretakers and producers.

II. Obstacles to technology transfer

21. A number of barriers causing the under-use of environmentally sound technologies have been discussed in document A/CONF.151/PC/17.

22. The pace of new investment is a critical determinant of the rate at which new technologies spread. Retro-fitting of existing facilities, the replacement of existing sub-optimal equipment and the expansion of the stock of equipment all require investment funds. In an economy with a high rate of investment relative to the existing capital stock new technologies can be diffused more rapidly.

23. Another important factor, which is related to the slow rate of new investment, is the availability of adequate financing to support the transfer of environmentally sound technologies to developing countries. Costs of new environmentally sound technologies are frequently greater than existing "polluting" technologies. However, in costing environmentally sound technologies, total life-cycle costs and effects of such systems of technologies should be considered, taking into account long-term beneficial effects. Given their present economic and financial problems, developing countries are, and will continue to be, constrained in securing necessary resources for acquiring environmentally sound technologies or developing their own endogenous capacities, without access to adequate financial flows.

24. Obstacles to transfer of environmentally sound technologies are also related to capacities, including human-resource base availability in developing countries, to assess, acquire, absorb, master and develop them. Technology suppliers may, in some cases, be unwilling to transfer technologies without adequate assurance that there exists the necessary supporting infrastructure to ensure safe implementation. Maintenance of high capital or skill intensive technologies can be difficult without the associated technological "know-how" and human resources.

25. Another category of barriers relates to the access to technological information, both on existing environmentally sound technologies and environmental risk from technologies on the international market. It is argued that there are insufficient effective arrangements for scientific and technological information exchange to help make environmentally sound technology decisions in developing countries.

26. The extent of the use of environmentally sound technologies is also linked to the prevailing environmental standards and the size of the market for them. Lack of information and insufficient level of requirements result in too small a market to be profitable for the sellers of the environmentally sound technologies and to be expensive for the buyers, particularly in developing countries. Also, the price set for the protection of patents can often be too high for the local market in developing countries.

27. Sometimes an unfavourable bias exists against indigenous environmentally sound technologies, which is particularly unfortunate as local conditions and needs are not always sufficiently taken into account in imported technologies. In this context, the importance of traditional knowledge both in its own right and in a blend with modern knowledge has to be stressed.

PART II Options for Action: Diffusion of Environmentally Sound Technologies

28. The broad objectives of a technology policy for sustainable development are increasing the endogenous capacity for technology development and adaption, ensuring effective technology cooperation amongst enterprises within and between countries and reducing the barriers to the transfer of environmentally sound technologies.

29. The realization of these objectives will involve action at the international level in the form of intergovernmental agreements as well as voluntary efforts by industry. Similarly at the national level, legislative and institutional action will be required as well as in the form of voluntary action by industry.

30. Actions to promote the development and diffusion of environmentally sound technology have to be seen in the context of available financial resources, scientific cooperation, education and other issues. This paper deals with general actions on capacity building and technology transfer the purpose of which is to provide a facilitating framework for the specific requirements which will be identified in the option on sectoral issues.

31. The issue of capacity building in developing countries is dealt with in Part III of this paper. The issue of financial resources which is intimately connected with technology transfer is dealt with in document A/CONF.151/PC/51 in general form. This part focuses on four programmes areas that address the problem of diffusion of environmentally sound technologies.

A. Measures to Promote Access to Technology

32. There are many different vehicles, methods or modalities by which technological assets are transferred. Included in these are foreign aid, direct foreign investment, joint ventures, licensing agreements, turnkey contracts, service contracts, technical assistance. Each vehicle is not exclusive and a simple transaction may include several of these vehicles. All of them are vehicles that operate as part of the investment process. It is therefore essential that sound economic conditions prevail in order to have a sufficient flow of investment.

33. It is difficult to assess the number of environmentally sound technologies where patent protection restricts their availability in developing countries. However, it is important to delineate the conditions that might apply for such technologies in the future. The primary rationale advanced for the importance of patent protection is to reward inventors sufficiently so that new investments continue in research and development.

34. The balance between assured and affordable access for users in developing countries to the latest environmentally sound technologies and fair incentives for and returns on research and development of new environmentally sound technologies is a key issue for consideration.

OPTIONS:

35. In order to promote access to environmentally sound technologies, the following options might be considered.

1. COLLABORATIVE ARRANGEMENTS BETWEEN DEVELOPED AND DEVELOPING COUNTRY ENTERPRISES FOR THE DEVELOPMENT OF ENVIRONMENTALLY SOUND TECHNOLOGIES

36. Joint ventures, together with direct foreign investment constitute important channels of transferring environmentally sound technologies. Collaborative arrangements between developed and developing country enterprises for technological cooperation could be further developed under a long-term partnership. Through this long-term partnership, sound environmental management practices could be transferred and maintained.

2. NEW FORMS OF INTERMEDIATION

37. An effective way of improving access to proprietary technologies could be through new forms of intermediation. Such new forms of intermediation could provide technology brokerage services including financing of the cost of transfer of technologies on a selective basis and providing expertise. The criterion for selective financing could be based on the discrepancy between social costs and private benefits, e.g. where costs of environmental degradation greatly exceed the short-term commercial interest.

3. CODES OF CONDUCT FOR TRANSNATIONAL CORPORATIONS

38. This could include provisions to encourage the diffusion by transnational corporations at a uniform pace of the latest versions of environmentally sound technologies throughout their organizations, while increasing research and development funds contracted locally by affiliate management. It could also cover an obligation to provide all the information necessary for safe and environmentally sound operation of industrial plants.

4. PUBLIC INTEREST PROVISIONS

39. Public interest provisions in existing legislation could be used to promote access to environmentally sound technologies. In the application of public interest provisions in order to encourage transfer of environmentally sound technologies, it would be necessary to define explicitly the scope and coverage of an environmental public interest.

5. LIMITATION ON OBLIGATIONS

40. Obligations under conventions could involve the use patent-protected technologies. It has been suggested that developing countries could be exempted from implementation until the patent expires, or till financial arrangements are established to cover the implementation burden on developing countries, as has been done in the case of the Montreal Protocol on Ozone Depleting Substances.

6. PRINCIPLES FOR DETERMINING CONCESSIONALITY

41. Specific arrangements for concessional transfer of technology would vary from case to case. However, the acceptance of certain principles may

facilitate such case decisions. The factors which need to be taken into account could be:

a. the extent of the discrepancy between social costs and private benefits (e.g. where costs of environmental degradation greatly exceed the short-term commercial interests);

b. the degree of effective competition in the supply of a given technology;

c. the type of obligation on citizens/governments (e.g. phasing out of CFCs), part of which may be counterbalanced by indirect or direct financial support; or

d. the relative advantage of using price discounts as an inducement to alter public or corporate behaviour to obtain a social objective.

B. Access to information and technology assessment

42. Both the access to technological information and the ability to undertake technology assessment are essential requirements in the transition towards sustainable development. Information on the environmental aspects of technologies has two interrelated needs, i.e. upgrading information on existing environmentally sound technologies and upgrading information on environmental risk from technologies on the international market. It should be kept in mind that there is no real shortage of information on environmentally sound technologies. Exceptions may be those from which the owner derives competitive advantage which transfer would put at risk. The problem is one of getting the right information to the right place and the right time in the most useful form.

43. Increasing access to information and ensuring that technological development takes into account the principles of sustainable development requires certain reforms and actions at the policy, institutional and programmatic levels. It also requires a sustained commitment in that direction. Following are some of the options which could be considered.

OPTIONS:

44. In order to promote and support access to technological information and technology assessment, the following measures may be considered.

1. CLEARING HOUSE AND INTERNATIONAL INFORMATION NETWORK

45. Many initiatives, both national and multinational, are currently underway to collate and disseminate information on the available environmentally sound technologies. Potential economies of scale and increased effectiveness may be gained by:

- coordinating these initiatives via a single clearing house for environmentally sound technologies;

- developing the clearing-house into an international information network for the disseminations of information on the available technologies, their sources, and broad terms on which they may be acquired;

- developing the clearing-house as a specialist research institute, which could be commissioned by clients in both developed and developing countries to advise on the relevance of different technologies in addressing specific problems; and

- establishing brokerage between a clearing-house and TNCs on the one hand, and leading research and development institutions on the other, to help facilitate access to the most novel technologies.

46. An efficient information clearing-house would demand national, regional and international funding commitments. Some international agencies have been funding information dissemination initiatives at the national and regional levels. However, the efforts so far have fallen short of the considerable demand for information transfer and dissemination required in the developing countries. National policy frames should be formulated in such a way as to provide technical support to extension services and related activities to improve transfer of information to the economically and socially disadvantaged populations in the country. In all cases special effort should be made to utilize science and technology infrastructure for producing appropriate information materials for the solution of local problems.

2. "BROKERAGE" MECHANISMS

47. In order to assist dissemination of information and transfer of technology, some additional "brokerage mechanisms" might be considered. They could act as intermediaries between financial sources, governments, research institutes, public and private entities and NGOs. Such a mechanism could assist, among other things, in assessing alternative technologies, sorting and identifying suitable technologies, developing mechanisms to overcome the practice of transfer pricing, developing appropriate guidelines and devising multilateral arrangements for funding and training.

48. A large portion of technology development takes place within public R & D institutions or in public systems involved in sewerages waste disposal, water supply, transportation, electricity distribution, etc. Often these take the form of better management, operating or maintenance practices. These "technologies" may be particularly valuable for the promotion of sustainable development. Yet the potential suppliers are often not organized for providing technology. The organizations which need these technologies may also be public systems, for mechanisms for the transfer of this type of public system expertise are limited.

49. Currently, various examples of bilateral and multilateral cooperation are being undertaken aiming at greater transfer of public domain technologies. But much more needs to be done to make information available to potential users and even to help potential suppliers to organize themselves for the transfer of expertise.

50. Special arrangements for public domain technologies in Clearing House and Brokerage Mechanisms might be considered with specific reference to suppliers of such technologies.

3. PROGRAMMATIC MEASURES

51. The following programmatic measures might be considered within existing mechanisms as well as proposed mechanisms.

Establishment of demonstration projects and programmes to show the feasibility and economic viability of "clean" and natural resource conserving industries and agriculture.

Support for firms that adopt a corporate image and activities that provide leadership in the transfer of environmentally sound technologies, including special support for "product champions" among such firms.

Development of methodologies for technology assessment and environmental standards.

C. Promoting environmental soundness in investment decisions

52. In order to reflect environmental priorities and to link technology transfer and development concerns within the framework of sustainable development, it is necessary for governments to formulate policies which take into account environmental concerns and provide specific incentives to encourage the use of environmentally sound technologies. Each government should examine its own policies to determine if subsidies, tax policy or regulations encourage or impede the introduction of sustainable technologies. Such policy reforms need to be embodied in norms, preventive measures and principles which reflect the internalization of environmental costs. Ultimately, both legislation and its effective implementation are needed. A variety of market and non-market instruments and mechanisms affect both the public and private technology systems (commercial/non-commercial; those that provide public and those that provide private goods; and both). Strategies for sound environmental management, for promoting more environmentally sound technologies and discouraging environmentally damaging ones must involve the right combination of market mechanisms and public intervention at each phase in the technology enterprise, including technology assessment, generation, transfer, implementation and internalization.

OPTIONS:

53. In order to imbed environmental soundness in investment decisions, the following areas for action deserve consideration.

a. Development of methodologies for improving environmental evaluation in public investment analytical framework, identification of tools needed and development of those tools;

b. A range of economic incentives that would promote the use of environmentally sound technologies;

c. Full-cost accounting (ecological balance sheets) for private as well as public sector;

d. Policy measures that would steer the process of technological innovation (R & D) towards environmentally sound products;

e. Advisory capacities or groups for diagnosing environmental hazards in specific investment situations;

In this respect, it may be necessary to:

assist developing countries to formulate such policies and regulations,

adopt the principle of "prior informed consent" 2/ for cases involving hazardous technologies,

incorporate environmental considerations into technology transfer agreements, such as assessing the environmental impacts before technology transfer and continuous monitoring of environmental effects of new and old technologies,

include technology assessment at R & D level in light of the shortening of product cycles and innovation chains.

D. Promoting research and development of environmentally soumd technologies

54. The issue of environmentally sound technologies cannot be seen solely from the point of view of transferring them. The successful transfer of technologies depends on endogenous capacities for absorption and adaptation, which in turn depends to some extent on endogenous capacities for technological research and development both at the firm level and in other organizations.

55. There are specific characteristics for each ecosystem such as climate, water bodies, soil or forest cover, which vary between countries and regions. Therefore, environmentally sound technologies have to be tailored to local conditions. In this context apart from modern scientific and technical capacities, the knowledge that traditional communities have acquired over many generations would also be relevant. Research and development programmes should also be tailored to address different environmental and technical conditions at different stages of socio-economic development.

56. Much of research activities and measures to enhance technological capabilities with respect to environmentally sound technologies requires a multidisciplinary approach and may involve collaboration across firms, governments and research institutions.

OPTIONS:

57. In order to promote research and development of environmentally sound technologies, the following options might be considered.

1. COLLABORATIVE EFFORTS AT NATIONAL AND INTERNATIONAL LEVELS FOR SPECIFIC MISSION ORIENTED PROGRAMMES

58. Collaborative efforts at national and international levels for specific mission oriented programmes such as energy efficiency improvements, new sources of energy, forestry conservation and sustainable agriculture, could be pursued and some mechanisms might be considered to involve universities, research institutions, local and transnational firms, and development

agencies, in which each participating party is required to contribute its specialized knowledge and expertise. Governments might also consider direct support for specific research activities.

2. PROMOTION OF EDUCATION AND TRAINING OF RESEARCHERS AND EXPERTS

59. Building up of a "critical mass" in Research and Development is crucial to the effective use and dissemination of environmentally sound technologies and to generate technologies locally. Education and training programmes should also reflect the needs of the specific mission oriented research activities, supported by policies, infrastructures and programmes to produce environmentally literate specialists with an interdisciplinary outlook.

3. INCENTIVES FOR INVESTING IN RESEARCH AND DEVELOPMENT

60. Many governments give incentives to firms for investing in research and development facilities. The basic purpose of these is to reduce the initial costs, spread the risks and allow firms to take a long-term view. These factors, particularly the last mentioned, are very relevant to investing in research, design and development of environmentally sound technologies. Certain possibilities like venture funding have been dealt with in the paper on financial resources (A/CONF.151/PC/51) in the discussion on the Earth Fund.

Part III Capacity Building in Developing Countries

61. A transition to sustainable development is imperative for the human future, both in economic and environmental terms. At the same time, it is clear that sustainable development cannot and should not be imposed from without. It can only be achieved by the decisions and actions of each nation on the basis of its own interests, needs and priorities, including its responsibilities to the international community.

62. Developing countries are especially disadvantaged in effecting this transition. They lack access to the financial resources and technologies they require to revitalize their economies while making the transition to sustainability. One of their most acute and immediate needs is lack of sufficient scientific, technological, professional and related institutional capacities to support these processes at the levels of policy and decision making, sectoral and cross-sectoral programmes and projects as well as research and development. In many cases the inadequacies of such capacities impair the ability of developing countries to evaluate their own development options, and to formulate and implement the policies, programmes and projects required to give effect to them. This can often be a serious handicap in attracting and absorbing the international assistance they may require.

63. External assistance, to be effective, must complement, supplement and support national initiatives, actions and priorities. It is thus of primary importance that the knowledge, experience and expertise of each country in the region be fully mobilized and engaged. Individually, these capacities are often relatively weak and insufficient in relation to the needs they must meet. Collectively, however, they often have the potential of adding up to a much more substantial capacity to respond to particular priority needs if they

were more able to work together and draw on each other's experience and capabilities. Given the facilities and linkages to enable them to do this, the whole can have a great deal more capacity than the mere sum of its parts. The utilization of modern computerized information storage and processing facilities in individual institutions and their linkage through telecommunications with others provides the basis for this and enables each institution to function as part of the whole network, giving it access to the capacities of the network as a whole. The establishment of such networks in each developing country is the principal purpose of the UNDP's Sustainable Development Network's initiative.

64. The establishment of such networks linking existing institutions enables their capacities to be utilized most effectively. It also facilitates greatly the process of determining where and how particular institutions can best be strengthened, which are in the best position to take a lead in respect of specific areas of specialization within the network as well as the strengthening process itself. It facilitates, too, the identification of needs for new institutional capacities as well as expertise and related education and training needs.

65. The transition to sustainable development by developing countries requires that they have access to the best available technologies. The affordability of such technologies is a primary constraint on their availability to developing countries. But equally constraining is the lack of adequate institutional and professional capacities to choose and to use such technologies. It is important that in choosing technologies to meet particular needs, developing countries have access to all available knowledge within their own country, as well as from external sources, as to the range of technologies available and the experience of others in the use of such technologies. They must also have the capacities required to guide and ensure their effective use.

66. Most developing countries are not able to provide the resources required to establish such networks amongst existing institutions and provide for the substantial strengthening and improvement of their capacities needed to support the transition to sustainability. Inadequacies of such facilities often leads to their own professionals and experts seeking more attractive opportunities outside of their countries. Those who remain at home are usually constrained by inadequate facilities and budgets. Nor do they have the resources or facilities required to enable them to have access to other sources of knowledge, experience and expertise within the country and region as well as outside of it.

67. This is true of a wide range of specialized professional and technical institutions, including those devoted to education, training, research and development and policy research as well as those contributing directly to operational programmes and activities. Such institutions exist in each particular sector, e.g. water quality, energy, agriculture, forestry, fisheries, climate, health, toxic substances and the other key areas included in sustainable development. Of growing importance, too, are the capacities, including systems analysis, needed to deal with the cross-sectoral dimensions of sustainable development issues. Indeed most such issues must now be understood and managed on a cross-sectoral or multisectoral basis and in most countries the capacities to do this effectively are at a very early and at an inadequate stage of development.

Regional initiative

68. Capacity building is not a new subject. Special measures have been undertaken in all regions designed to strengthen professional and institutional capacities and related programmes of education and training. Many of the elements required already exist. The extent of these and the resources available to support them is, however, still very limited in relation to the capacity building needs of developing countries. The preparatory work for the 1992 Conference on Environment and Development is making clear the extensive nature of the capacity building needs of developing countries and the importance of these in terms of environment and development. It is also helping to identify these needs in respect of each of the key issues being addressed in Agenda 21, the programme of action to be submitted to the Conference. These needs are being defined primarily in global terms; yet it is recognized that in most cases the capacity to meet them must be met primarily through strengthening of capacities at the national and regional levels.

69. The 1992 Earth Summit provides a unique opportunity to obtain the political sanction and commitment to the process of capacity building. Accordingly, it is proposed that the leading environment and development organizations of each region join in providing to UNCED the benefit of their advice and guidance as to existing professional and institutional capacities in their region and the needs and potentials for linking, strengthening and improving such capacities in the environment and development areas to be addressed by UNCED in Agenda 21, including:

i) identification of existing capabilities - research and development institutions, technical institutes, university programmes etc, and their potentials and needs for strengthening and improvement as seen from the perspective of their country and region;

ii) identification of institutions which are or could be in a position to take a lead within the region in respect of a particular area of specialization; the existence of current facilities and identification of additional needs for accessing and disseminating information and exchange of experience within the region;

iii) identification of sources of information on available technologies to meet particular sustainable development needs and the experience of the countries within the region in using them as well as on alternative technologies;

iv) identification of existing facilities for linking institutions within one region with their counterparts in other regions and with external sources of knowledge, experience, expertise, technologies and financial and technical assistance and the needs and potentials for expanding such facilities.

70. It is recognized that within the time available this exercise would primarily consist of assembling and analysing the information now available from regional organizations and national sources. UNDP Resident Representatives are being asked to provide this information in respect of each of their countries of assignment. It is expected that this will produce a

preliminary survey of professional and institutional capacities in each region together with guidance on the needs and potentials for strengthening such capacities and establishment in each region of a "sustainable development and technology support system" and how these could be most usefully related to or integrated with existing programmes, including particularly the UNDP Sustainable Development Network initiative. The results of this survey, together with the work being undertaken on an issue-by-issue basis in the working parties established by the UNCED Secretariat, will be the basis for establishing the specific proposals that will go to the Preparatory Committee for the 1992 Conference for their consideration and recommendation to the Conference itself.

71. In cooperation with UNDP, a small task force is being set up in each developing region (as defined by the United Nations) to conduct this preliminary survey in the region and provide UNCED with the results of the survey and its recommendations and guidance in respect of the capacity-building potentials and needs in the region. The task force would consult closely with the regional development bank for the region, the UN Regional Economic Commission, the other principal regional organization or organizations, UNEP and the World Bank. UNCED will make available to each task force relevant information available through the work of its working parties and facilities to ensure coordination of the work of the regional task forces with other related aspects of its preparatory work.

72. The work of the task force must be completed by 1 November 1991 in order to be incorporated into the documentation for the final session of the UNCED Preparatory Committee.

Possible follow-up arrangements

73. While it would be premature at this point to anticipate the specific arrangements that might be made to give effect to a major new capacity-building initiative, should this result from the proposed survey, it is not expected that this would require establishment of a new central institution. Rather, it is more likely to give rise to establishment of specific mechanisms for coordination and cooperation amongst the existing institutions which are involved in providing support for development of professional and institutional capacities in each region. This might, for example, include provision for establishment of a consultative group mechanism to mobilize funding for capacity building, supplemented, perhaps, by a special fund which could play a lead and catalytic role in respect of such mobilization and a technical advisory group.

74. It is envisaged that such arrangements would be organized on a regional basis within the framework of a globally co-ordinated programme. The issue of a special fund is dealt with in the document on Financial Resources (A/CONF.151/PC/51).

Notes

1/ Paras 5 and 6 are based on: "Transfer and Development of Technology in a Changing World Environment: the Challenge of the 1990s". Report by the UNCTAD secretariat TD/B/C.6/153, 25 January 1991.

2/ Prior Informed Consent (PIC) refers to the principle that international shipment of a chemical that is banned or severely restricted in order to protect human health and the environment should not proceed without the agreement, where such agreement exists, or contrary to the decision, of the designated national authority in the importing country. (London Guidelines, 1989)

PIC Procedure is a procedure for formally obtaining and disseminating the decisions of importing countries as to whether they wish to receive future shipments of chemicals, which have been banned or severely restricted. (London Guidelines, 1989)

UNITED
NATIONS

A

General Assembly

Distr.
GENERAL

A/CONF.151/PC/54
11 July 1991

Original: ENGLISH

PREPARATORY COMMITTEE FOR THE UNITED NATIONS
CONFERENCE ON ENVIRONMENT AND DEVELOPMENT
Third session
Geneva, 12 August - 4 September 1991
Plenary Session
Item 2 (c) of provisional agenda

ENVIRONMENTAL HEALTH ASPECTS OF DEVELOPMENT

CROSS-SECTORAL ISSUES

Report of the Secretary-General of the Conference

1. Decision 1/28 of the Preparatory Committee for the United Nations Conference on Environment and Development (UNCED) was addressed to the World Health Organization (WHO). In response, the WHO prepared a first progress report which was submitted as document A/CONF.151/PC/19 to the Preparatory Committee for consideration at its second session. Continuation of work on this subject was endorsed at the second session through Decision 2/6 on cross-sectoral issues.

2. The present report provides a contribution to Agenda 21 in the area of human health. This is preceded by a summary review of key linkages between development, environmental degradation and human health consequences, considering that human health is threatened by both the lack of development, and by development not accompanied by the necessary environmental safeguards.

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3. The WHO Commission on Health and Environment will have held its final session in Geneva, 15-19 July 1991, after this paper had been finalized. Consequently, its final conclusions and recommendations will be reported orally to the Preparatory Committee at its third session. The section on health for Agenda 21 will be adjusted accordingly prior to its fourth session.

4. In addition, the Ministers of the Environment and of Health of the Member States of the European Region of WHO, in December 1989, adopted the European Charter on Environment and Health which covers agreed upon principles and strategies. Also, the Sundsvall Conference on Supportive Environments, 9-15 June 1991, identified action for public health. Its aim was to find practical ways to create physical, social and economic environments supportive of health and compatible with sustainable development, and to build bridges between sectors for practical problem solutions. Relevant principles, strategies and recommendations are being considered in the preparation of Agenda 21.

PART A: BACKGROUND AND ISSUES

I. INTRODUCTION

5. Health depends on a good environment. Both are desired by everyone, and development has brought better health to many. In the developed countries undernutrition and virtually all the infectious diseases associated with poor water, sanitation and housing have almost disappeared. In large areas of the developing countries, however, the very lack of development coupled with increasing population growth has had an enormous adverse effect on human health due to environmental insufficiencies and degradation. The lack of adequate and safe water, shortages of food, the lack of sanitation and grossly insufficient housing for well over one billion people are largely responsible for the many diseases which take their toll on the health and life of these populations. It is clear that economic and social development is of high priority.

6. Development has, however, not come without a price for the environment or for human health. Depletion of resources, pollution of air, land and water, and changes in hydrological regimes and vegetation cover, to name a few examples, have had deleterious effects on the health and lives of large numbers of people. Rapid urbanization and the increasing populations have made it necessary for hundreds of millions of people to reside in over-crowded and unsanitary settlements. It is clear that the battle against environmental hazards cannot be won easily, for as old problems are solved, new ones appear as the unwanted by-products of industrialization and economic development. This has been seen in the industrialized countries where microbiological pollution of water supplies and massive pollution of cities by smoke and the other common air pollutants have been largely solved, only to find "new" potential hazards in the form of minute quantities of various chemical compounds and certain physical factors with a potential threat to the health and well-being of the people.

7. Many of the countries of the world, particularly those that are in the midst of rapid industrialization, are faced with both problems - the ones still remaining because of lack of development and the ones that have

accompanied development without sufficient protection measures for health or for the environment. This part of the paper highlights the primary issues for health of both of these. Included also is a brief mention of the linkages with other issues in front of the Preparatory Committee, including the health implications of global concerns of atmospheric change, and loss of biodiversity.

II. HEALTH PROBLEMS DUE TO LACK OF DEVELOPMENT

8. The health and disease patterns of developing countries, mostly in tropical environments, are determined by poverty and poor distribution of economic resources, lack of capital investment, a high proportion of population engaged in agricultural activities, crowded and poorly serviced housing in both rural and urban areas, low levels of literacy and unrestrained population growth. The lack of social and economic development contributes to the status quo of all these health determinants.

9. Underdevelopment is linked to poor maintenance and inadequate management of the environment. Thus the endemicity of parasitic diseases, malaria, schistosomiasis, filariasis, onchocerciasis, dracunculiasis (guineaworm) leishmaniasis, African trypanosomiasis and intestinal parasitic infections is sustained in the milieu of inaction. However many of these disease problems may not be reduced - they may in fact increase - if development efforts do not avoid environmental degradation through deforestation, alteration of hydrological systems, desertification and erosion and the ensuing changes in populations movements and habitat. The epidemiology of these diseases is determined by the ecosystems of their respective vectors and the social, cultural and economic activities of the people. The public health importance of these diseases vary from one developing country to another and the lack of development will have different impacts on their progression, extention and aggravation.

10. There is a global recognition that continuation of the present rates of population growth will deter most, if not all, efforts to reduce the environmental degradation and hence the health effects. The lack of development is a paradoxical contributor to increased population growth.

11. Poverty, as a composite index of deprivation extending from command over economic resources, access to education, social support, and self-esteem, to control of housing and physical environment quality, remains the most significant predictor of urban and rural morbidity and mortality. The powerful association of poverty and poor health is evident for communicable, non-communicable and psycho-social diseases, and is reflected in comparison of health statistics between countries, within countries, and even between poor and less poor villages within a single district.

12. Taking both rural and urban poverty into account, the International Labour Organization (ILO) estimated that the number of people in the third World living in extreme poverty increased from 819 million in 1980 to

881 million in 1985. This is an increase of 62 million or 7.6 per cent in just five years. Moreover, on the basis of present population growth projections and assuming that the distribution of income remains unchanged, the ILO projects a further rise in the number of living in extreme poverty to 913 million by 1995 which may be distributed as follows:

POPULATION LIVING IN POVERTY

	1980	1985	1995 (projections)
Africa	210	278	405
Asia	562	538	450
Western Hemisphere	47	65	58
Total	819	881	913

Roughly, 90 per cent of the absolute poor live in rural areas, considering the Third World as a whole ("absolute poor" being determined nutritionally).

13. Lack of education is at the roots of the lack of development. On the other hand, without development the rates of education and basic literacy will remain low. Maternal education is a powerful determinant of child survival. Education is essential to enhance the capacity of the individual and communities in developing countries to take initiatives to protect and promote health.

14. Development brings with it new roads or canals, that offer enhanced access to markets and better ways to move agricultural produce and industrial goods. In tandem, electrification raises the capacity of local economic activities, agricultural production and food processing, and improved sources of domestic water supply and management of sanitation. Radio and television are powerful tools in the environment - health - development process; allowing increased access to information will potentially change attitudes towards health and the environment.

15. Lack of development forces the continued use of increasingly scarce biomass, in the form of wood or other types of biomass, and exposes 700 million persons to increased risk of acute and chronic upper respiratory disease. Women and children are particularly vulnerable due to the use of this biomass in inefficient and poorly ventilated stoves which maintain high concentrations smoke and toxic gases in the home. Biomass fuel and low-grade coal use contribute to the twofold higher mortality due to obstructive lung disease in developing countries as compared to developed countries.

16. The current figures on the extent of human suffering due to disease in developing countries are staggering. Mortality under age five years is close to 100 per 1000 live births and 14 million children die annually in the first five years of life. Most of the deaths are due to acute respiratory diseases (4.3 million) and diarrheal diseases (4 million). High infant mortality is the major factor in the shorter life expectancies at birth in developing countries, e.g. 54 years in Africa and 68 years in Latin America compared to 75 years in developed countries.

17. Nutritional deficiencies, caused by lack of food crops or access to food supplies, increases the vulnerability in children to infectious diseases and is compounded by the lack of sanitation and water supplies. 15-20 per cent of the developing world's population suffers from insufficient food intake. 16 per cent of all infants, some 20 million children, are born with low birth weights and the highest prevalence is observed in the developing countries of sub-Saharan Africa and Southeast Asia.

18. Crowded quarters and lack of vaccination, as well as continued exposure to high levels of indoor air pollution from incomplete burning of low-grade fuel and poor ventilation, contribute to the occurrence of outbreaks of respiratory diseases. Among these tuberculosis remains one of the most dramatic effects of the lack of development. Having nearly disappeared as a cause of death in the industrialized countries, 60 per cent of the 2.5 million deaths still occur in South-East Asia among economically productive adults, and the remaining cases occur in other developing countries.

19. Inadequate disposal of human excreta, combined with water shortages limiting personal hygiene are the main cause of the repeated occurrence of diarrhoeal episodes (some 1,500 million in children in 1989) due to contamination of food and drinking water.

20. Some forms of cancer are more common in the tropics than in temperate areas are due to environmental factors. Cancer of the liver is a frequent sequela of hepatitis B - a very common but often inapparent infection in tropical countries, probably transmitted from carrier mother to child. While the infection itself is unrelated to the environment, the eventual development of hepatocellular carcinoma in people that have been so infected appears to be favoured by continued asymptomatic exposure to aflatoxins produced by a mould in cereals and other foodstuffs that have been stored in a humid and hot environment. Urinary schistosomiasis, endemic in 55 countries, is associated with an otherwise unusual type of cancer of the bladder, making it one of the most frequent in highly endemic areas.

21. Lack of access to health services is a fundamental characteristic of underdevelopment. The inadequacy of health services is directly reflected in absence of prevention of infectious diseases. Although immunization coverage in children throughout the world has reached 65 per cent, the proportion of children immunized in Africa is less than 50 per cent. Availability of oral rehydration, a simple and effective intervention, for control of diarrheal diseases is much more limited in least developed countries.

III. DEVELOPMENT RELATED HEALTH HAZARDS

22. Development is the process of fulfilling people's legitimate aspirations to adequate food and shelter, sufficient and safe water supply, access to education and health care. It involves changes in resource availability, patterns of consumption and greater participation of people in decision-making. Development means greater equity, government systems which are more representative, decentralized and accountable, more community involvement, and an increasing trust of the responsibility and skills of local

people. Inevitably, the process of development will have short and long-term environmental and therefore health implications. The dilemma will be to avoid or minimize conflicts between economic development, necessary for the immediate improvement of human health, and the protection of the quality of the environment on which the long-term maintenance of human health critically depends. Only a few examples can be given here, concerning key aspects of agricultural practices, energy production and industrial development, that suggest how human activities related to development can affect human health through their interaction with the environment.

Intensified Agricultural Production

23. Increased availability of safe and nutritious food requires extension of cultivated areas and therefore of water resources, adoption of intensive farming practices, reduction of pre- and post-harvest losses, spoilage and wastage, improved distribution. The achievement of each of these has environmental implications with health consequences that require careful weighing before decisions are made. Because most productive land is already under cultivation, extension would inevitably take place at the expense of marginal land or forests whose poor soils would be further impoverished, resulting in erosion, soil degradation and, ultimately, in desertification, undermining the very productive base on which populations need to rely for improving their nutritional state. In addition, the move into new land may expose farmers and their families to unfamiliar diseases against which they might not know how to protect or they do not have immunity.

24. Increased productivity can be achieved using increasing amounts of fertilizers, introducing or expanding irrigation or switching to new crops or cultivars. Each of these options has its environmental consequences and health implications. The liberal use of chemical fertilizers may threaten the quality of both surface and ground waters posing risks of methaemoglobinaemia (blue-baby syndrome) in infants and of eutrophication with reduction of freshwater resources. Switching from cash crops to subsistence crops means forswearing major sources of tradeable produce and therefore of income. Reduction of pre- and post-harvest losses requires the use of pesticides and, unless intensive educational programmes are conducted and good practice used, will result in unnecessary exposure and accidents of the type described below. Avoidance of spoilage requires adequate storage facilities to avoid losses and careful inspection of food to ensure its safety. Because highly populated areas are not necessarily the most productive, reliable means of rail and road transport are needed if mass movements of people in search of food are not to occur. Peace and adequate income are obviously required to ensure that food is available to all.

25. The need to increase agricultural production has led to the widespread use of chemicals to control weeds, moulds, insects and other pests. Developed countries have so far been the main producers and users of pesticides but the percentage growth in use has been increasing much faster in developing countries, especially Africa. A much greater fraction of the population being engaged in agricultural activities in developing than in developed countries, exposure to hazardous pesticides is also greater. The main risk is acute poisoning from single short-term exposure, sometimes due to attempted suicide

(an event that is not infrequent in some countries) but mostly because of unintentional misuse or inadequate protection. Severe cases, including attempted suicides, are estimated to number 3 million per year, of which over 200,000 end in death. A larger number of milder cases go unreported. In addition, some 750 000 cases (5 per cent of them cancers) of chronic effects from long-term exposure are thought to occur yearly. The great majority of both acute and chronic cases occur in developing countries.

26. Nearly half of the world's population of 5 billion people are at risk of malaria, a risk which is sustained by deforestation, irrigation, strip mining and urbanisation. A majority of the 1-2 million deaths from malaria each year occur in the "frontier" areas of economic development.

27. Schistosomiasis is a scourge of water resources development in small reservoirs and irrigation systems, and now threatens the urban periphery in northeast Brazil and Africa. Six hundred million people are exposed to the risk of schistosomiasis infection. Water resources development also contributes to the risk of filariasis for 905 million people, with the risk of disfiguring elephantiasis of the extremities and genitalia. Dracunculiasis (guineaworm) associated with small water bodies threatens degraded endemic areas. Rural development without attention to environmental protection promotes the breeding of Aedes, the mosquito vector of dengue and yellow fever, whose recent spread in the Americas in this decade has been dramatic.

28. Leprosy affects up to 12 million persons, 2/3 of whom are found in areas of environmental degradation in the tropical forests of Latin America, Africa and South East Asia.

29. Increasing rodent population in areas of intensive irrigated agriculture are creating new health risks of bacterial, viral and parasitic diseases. Examples are the newly recognised high incidence of relapsing fever in irrigated areas of northern Senegal, and the continuing spread of Lyme disease, both associated with ticks and small mammals.

Industrialization and Energy Production

30. Industry is necessary to produce the building materials, the tools, the machinery and the chemicals (including medical and veterinary pharmaceuticals) that a country would otherwise have to import. It is also necessary to create exports, especially in those countries that, switching from cash to subsistence crops, are losing a source of external income or may be forced to pay for imported food. Industrialization is therefore an essential ingredient of development, but would not be possible without the availability of affordable energy sources. Basic as it is to industry, energy has a major role in making it possible to cook food and heat houses, but also to raise and distribute water and to power vehicles. Immediately related to health, energy is needed in an urban environment to power purification and water treatment plants and run medical and hospital facilities. Coal and petrol currently represent the major sources of energy as well as the main feedstock for chemical energy. Hydropower will certainly be further developed in some

countries. Nuclear power is unlikely to be extended significantly beyond those countries that now use it and those with facilities under construction. Other forms of energy, except biomass for domestic uses, are at present of marginal importance.

31. Developed countries provide countless examples of both the benefits of industrialization and energy availability, and of the harm that they both have inflicted to the environment and, through it, to human health when poorly planned. Though not exclusive of that area, this is nowhere more apparent than in parts of Eastern Europe plagued by major problems due to irrational siting of industry, large scale use of poor fuels such as soft coal, lack of control equipment, unrealistic legislation and inadequate surveillance of workers. The situation there is the legacy of a disregard of predictable environmental damage and, at least initially, ignorance of its eventual effects on human health.

32. Preoccupation with the problems arising from these should not lead to losing sight of the reflections of development in the household. Availability of electricity and bottled gas, still a dream in most developing areas, will reduce indoor air pollution and bring down the prevalence of respiratory diseases. But the development of cottage industries will also increasingly become a significant component of economic development and present at micro-level many of the problems of larger-scale activities. Checking them is much more difficult owing to the multitude and diversity of foci involved, with activities ranging from electroplating to tanning to weaving to dry-cleaning. Yet their very number and ubiquity may have an environmental and health impact as serious as that of the much less numerous heavier industries. Exposure of the workers, including children, to unsanitary working environments and exploitation may be common. Inspection, infrastructure and training designed for the special conditions of cottage industry will be necessary.

33. Air pollution is the most obvious and more generalized environmental change from industrial activities and energy production and use. It affects human health directly, as mentioned earlier, as well as through the damage it brings to buildings, vegetation and freshwater resources. There is no reason this should happen. Thoughtfully selected siting, use of pollution control equipment appropriate to the fuel or feedstock processed, rational disposal of wastes and strict compliance with good operational practice, and continued adherence to workers' protection measures should ensure that environmental and health problems are reduced to a minimum. The major difficulty will be to set up the infrastructure that makes planning, operation, surveillance and quality control effective and routine, and to avoid tempting technological short cuts. These short cuts may appear economic in the immediate term, but will be paid for later in terms of environmental and health damage, and ultimately in extremely high costs for clean-up and restoration. Training of responsible manpower at all levels to be aware of the environmental hazards that their activities may bring about is a necessarily expensive but essential component of any large scale expansion of industrial and energy-producing activities.

34. Industrial accidents may involve scores or thousands of individuals when they happen in large plants handling or containing hazardous materials, or when whole valleys are flooded with the bursts of high dams. Industrial

accidents have occurred in developed and developing countries alike. But taking into account the fact that developing countries have only a fraction of the industrial and energy-producing world potential, the frequency of serious accidents is unacceptably high. Weakness of the regulatory system and laxity of its enforcement, often obsolescence of equipment are likely to be the principal causes of accidents. Sometimes the adoption of new and locally untried technologies or the hasty adaptation to local conditions of technologies well tested makes accidents more likely if workers and their supervisors lack experience with the hazards of the technologies and how to control them. Often local medical and hospital facilities lack the means, the experience and the versatility for handling a sudden influx of victims presenting with unfamiliar symptoms. Prevention of accidents through discipline and preparedness must be a constant preoccupation of all countries, but the need is the more urgent in newly-industrialising countries.

Urbanization and Urban Development

35. Urban growth has outstripped society's capacity to meet human needs, leaving hundreds of million of people with inadequate incomes, inadequate diets and inadequate housing and services. All too often urban development is associated with destructive effects on the physical environment and the resource base needed for sustainable development, leading to illnesses, accidents, crime and other social pathologies.

36. In the developed countries, where population growth has slowed to very low rates, the major impacts of urban development on health and the environment result from technological changes, from changes in family and social structures associated with psychosocial problems such as drug abuse, crime, mental illness, and vandalism, from poverty, increased consumption of resources, changing diet, changing residential patterns, shifts in transportation, and the exhaustion of the environment's capacity to absorb wastes. Many of their cities need to extend and replace deteriorating infrastructures and to control pollution more effectively.

37. In developing countries, the major impacts of urban development on health and the environment result from:

a. rapid and massive urban population growth, both in the increasing number of megacities and in secondary cities;

b. crowding and "densification" of human settlements, with overcrowding, congestion, and traffic, and increased occupation of urban land subject to landslides, floods, and other natural hazards;

c. ever-growing numbers of people living in extreme poverty, many of them - especially women and children - at high health risk;

d. increasing biological, chemical, and physical pollution of air, water and land from industrialization, transportation, energy production, and the increasing generation and improper disposal of commercial and domestic wastes; and

e. the overwhelming of the financial and administrative resources of cities to provide such infrastructure as water and sanitation, to provide for adequate employment and housing, to manage wastes, and to ensure security, environmental controls, and health and social services.

38. Urban health problems occur in all countries, but are most severe in developing countries, because (a) their urban populations - and particularly those living in poverty - are growing so fast, (b) environmental changes have produced a pattern of health problems that includes both the diseases typical of underdevelopment, and the diseases typical of developed communities, (c) the resources for response are relatively meagre, maldistributed and misplaced, and (d) inadequacies in governmental structures and policies inhibit effective responses.

39. Urban development has been associated with new communicable disease risks. Examples include: AIDS, where a major contributing factor in the current pandemic is the degradation of the rural environment and the ensuing deterioration of urban social conditions; poor housing in urban and rural slums in Latin America exposes 90 million persons to risk of Chagas' disease; once a rural disease, leishmaniasis is now a risk in urban areas in the Eastern Mediterranean and South East Asia; dog rabies remains a threat to 2.8 billion people.

40. The concentration of resources - economic, technological, human - in cities provides a stronger basis for action than is found in more dispersed rural settlements.

41. Many developed countries still experience high levels of pollution in urban areas from industrial activities, energy production and use, and, increasingly, transport. Air pollution is responsible for a significant fraction of chronic respiratory diseases and asthma. Some studies have noted an association with lung cancer, but a causal relationship has not yet been proven. Lead-based antiknock additives to petrol, emitted to the atmosphere from car exhausts, are still one of the major sources of exposure to lead in many countries. The results of a number of investigations indicate that the neuro-behavioural development of children is significantly and irreversibly impaired by such exposure.

42. Transport accidents, particularly car accidents, are a major cause of mortality, morbidity and permanent disability in both developed and developing countries, in urban and rural areas. Indeed in most industrial countries they rank third (after heart disease and cancer) as a cause of lost years of life.

IV. LINKAGES TO OTHER ISSUES

43. Each of the substantive issues considered by the two Working Groups of the Preparatory Committee have health dimensions, although to varying degrees. Health considerations are central for dealing with urbanization, freshwater supplies, toxic chemicals and hazardous wastes, and they have been referred to in this paper, as well as in the papers on these specific issues.

In addition, there are the primary global problems such as global atmospheric changes and loss of biological diversity which, too, have implications for health. A brief outline of these is given below.

Health consequences of global atmospheric changes

44. Global changes in atmospheric composition, especially an increased concentration of "greenhouse" gases of which carbon dioxide is the most important, could have major consequences for human health by altering climate and raising the sea level. Food production may be reduced by climatic change and flooding of low lying areas. A rise in sea level involving dense population areas could also provoke large numbers of refugees. Global warming is likely to create conditions that alter the distribution of vectors of disease, such as mosquitoes. The increase in level and duration of heatwaves will have a severe impact on those persons with impaired cardiovascular, respiratory, endocrine or immune function, and infants and children and the elderly are likely to exhibit increased morbidity and mortality associated with this heat stress.

45. Continued releases of chlorofluorocarbons used as foam blowing agents, refrigerants and electronic circuitry cleaning agents deplete the stratospheric ozone layer which absorbs solar ultraviolet B radiation. Should the ultraviolet flux at ground level increase significantly a rise in skin cancers is expected. This is now happening among fair-skinned adults, but is probably still unrelated to ozone depletion but rather due to intense exposure to sunlight.

The importance of maintaining biodiversity

46. The maintenance of the diversity of ecosystems and of living species and strains is as essential to the preservation of a fully functional environment and to the very existence of life on earth as the maintenance of the quality of air, waters and soils. Since there is another document which considers the issue from various viewpoints, only the health implications of the disappearance of ecosystems and species is examined here.

47. To the extent that health is dependent on the integrity of the environment, biodiversity is a major concern in promoting health effectively. There are also more specific if subsidiary considerations that justify it on a global scale. The natural history of a number ecosystems is poorly known and their species not yet inventoried. Tropical forests, coral reefs, and mangrove swamps, but also arid grasslands and mountain tundras are the most glaring examples. They are all in the process of being seriously damaged or destroyed. The species communities they contain are highly diverse and contain strains that, crossed with domestic varieties, have provided new cultivars with higher yields, resistance to arid conditions or other desirable features, thus contributing significantly to the solution of feeding people. Some species have yielded invaluable drugs, from quinine to reserpine, and more may be present in inadequately explored habitats. Arthropods, many of them still not described or classified, may be used to combat pests, thus reducing crop losses, or disease vectors.

48. All these reasons make the conservation of biodiversity a priority for health. The respect for biodiversity, however, cannot be blind. There are species unconditionally harmful to people. There are habitats where those species breed. Eradication of these scourges should not be avoided for the sake of maintaining biodiversity, but neither should eradication be carried out without careful weighing of its environmental consequence.

V. THE NEED FOR HEALTH-ORIENTED DEVELOPMENT ACTION

49. Sustainable development is a strategy for social and economic development which implies the meeting of the needs of the present generation without compromising the ability of future generations to meet their own needs. It follows that health and sustainable development are interdependent; but the relationship is also reciprocal: sustainable development depends on efforts to improve health and to reduce environmental risks to health; achievement of health for all in accordance with the principles of primary health care depends on the sustainability of social and economic development, on the sustainable use of natural resources for reliable food supplies and energy for human development, on healthy cities and on the prevention of environmental health risks which originate in the development process itself.

50. Mutual support of health and sustainable development can be achieved only through simultaneous strengthening of health services and promotion of effective collaboration between all public sectors in matters of health. Each sector will have to determine the contribution it can make to sustainable development in the light of its own mandates and programmes and its human and financial resources. This applies fully also to the national health agencies and to WHO. Fulfilment of the health-and-conservation approach requires committeed efforts at all levels, down to the grassroots, where the successful implementation of primary health care involves community participation in determining priorities in the development process. The construction of a permanent health infrastructure strong enough to meet present health needs, and flexible enough to respond adequately to future needs as they arise, is a key component of sustainable development.

51. There is a growing awareness in other public sectors of the role they may play in the promotion of human health, of the adverse effects their development activities may have on human health, and of the need to minimize such effects through intersectoral preventive action in collaboration with the health authorities. This awareness has yet to be translated into policies.

52. New health problems associated with development will require more research as a basis for more informed decision-making in the interests of sustainable development. These problems are no longer faced by the industrial countries alone; they are becoming a challenge also in the developing countries, especially the exposure to pollution and contamination (chemical, physical and biological) in water, the air and food, at the place of work, even in the home. More research is needed also on the health aspects of food supply and proper nutrition, and of life and lifestyles in urban and peri-urban areas where crowding and many other determinants affect the

physical and mental health of a large number of people. WHO has a major role to play in achieving a better understanding and in undertaking assessments of the complex interactions between these factors and health, and of the technology available for their control.

PART B: OPTIONS FOR AGENDA 21

Programme Areas

53. As outlined in the previous section, the impacts on human health of, both underdevelopment, and unsustainable development, can be enormous and diverse. The actions which are required to deal with this situation also need to be substantial and cover a wide ground. Four main areas have been identified for consideration for Agenda 21. They are:

A) Basic Health Needs Related to the Environment;

B) Control of Communicable Diseases;

C) Meeting the Urban Health Challenge;

D) Reducing Health Risks from Environmental Pollution and Hazards.

Each of these is described in the following sections.

The programme activities relevant for (A) and (D) above are dealt with largely in the relevant sectoral papers. They are listed here mainly to show clearly the need for a broad-based approach to health and environment.

A. BASIC HEALTH NEEDS RELATED TO THE ENVIRONMENT

Basis for Action

54. Despite some improvement in the 1980s, a large proportion of the population of the developing world still has no ready access to safe water and sanitation. The situation is worst in three WHO regions, with a total population of well over two billion people.

Population lacking safe water and sanitation in three regions 1990

	Africa (millions)	South-East Asia (millions)	Eastern Mediterranean (millions)
Population	487	1 310	392
No safe water	263 (54%)	452 (35%)	108 (28%)
No adequate sanitation	263 (54%)	935 (71%)	224 (57%)

55. Globally, food grain production has been rising faster than the population and should be sufficient for decades to come, but about one fifth of all people live in a state of absolute poverty with insufficient means to meet their daily needs. Each year many millions face hunger or starvation as a result of natural catastrophes, crop failures and the effects of conflict and civil strife.

56. By the year 2000, it is estimated that the already vast numbers of urban poor will have risen to include 77 per cent of all families in cities - the majority living in slums and shanty towns with all the health risks and social deprivation that this entails.

57. Specific options for action on water supply, sanitation and shelter are dealt with in the options for Agenda 21 for Freshwater (A/CONF.151/PC/42/Add.7), Solid wastes (A/CONF.151/PC/42/Add.10) and Human settlements (A/CONF.151/PC/56).

B. CONTROL OF COMMUNICABLE DISEASES

Basis for Action

58. Advances in the development of vaccines and chemotherapeutic agents have brought many communicable diseases under control. However, many important communicable diseases remain for which environmental control measures are indispensable - diarrhoeal diseases, leishmaniasis, malaria, schistosomiases and other vector-borne diseases, to mention only a few.

59. In all such instances, the environmental measures, either as an integral part of primary health care, or undertaken outside the health sector (municipalities, planning authorities, departments of the environment, agricultural development programmes etc.), form an indispensable component of overall disease control strategies and, in some cases, even the only component. Environmental control of communicable diseases includes water supply and sanitation, pollution control, food quality control, integrated vector control, garbage collection and disposal. Unfortunately, the standards and degree of coverage of environmental health programmes leave much to be desired in many countries, due to lack of resources, imperfect understanding of the problem, or poor planning and weak environmental policies. As a result, much damage has been done to the quality of the environment and human health, which will require great effort and vast resources to repair.

60. The major challenge for the 21st Century and beyond will be to have health incorporated as a legitimate development objective. The development community needs to undergo a major change in attitude and action. Health needs to become a central concern and not to be addressed as a marginal problem after everything else.

Objectives

61. At national level, action plans for the environmental control of communicable diseases need to be established as intersectoral initiatives, - advised, coordinated and monitored from within the public health sector.

These plans should define goals and objectives in terms of reductions in the rates of disease and death due to communicable diseases associated with the environment.

62. A global monitoring system for endemic diseases, in particular those with a potential for transboundary spread, based on data collection at the primary health care level, should be operational by the year 2000. Specific targets have been set by WHO for:

(a) elimination of Guinea worm by the year 2000;

(b) eradication of polio and measles by the year 2000;

(c) effective control of onchocerciasis (river blindness) and leprosy by the year 2000;

Indicators of progress are reductions in the incidence and the associated morbidity and mortality of the main communicable diseases related to the environment, e.g. malaria, cholera, hepatitis, sleeping sickness, soil-transmitted helminths and schistosomiasis.

Activities

63. Control of endemic diseases is not the exclusive responsibility of the health sector. It requires intersectoral cooperation and coordination, which in many countries today are lacking, fragmented, inadequate or ineffective. The roots of this failure lie in political and administrative constraints, which prevent interaction, dialogue and the coordination of activities within the overall developmental process. National action plans must therefore include:

(a) strengthening of intersectoral action through the secondment of experienced health professionals, to relevant sectors, such as planning, housing, agriculture;

(b) development of guidelines for effective intersectoral coordination, to be included in professional training curricula and post descriptions including the assessment of risks and development of control methodology;

(c) intensifying multidisciplinary research into the identification of health risks associated with the environment, particularly in the context of development including focus on the mitigation and environmental control of tropical diseases linked with development.

(d) wider application of environmental management methods in the prevention and control of vector-borne diseases and other communicable diseases associated with economic development;

(e) improving public information and health education on the risks of endemic communicable diseases and on environmental methods for their control;

(f) increasing the capacity of national public health systems to identify environmental hazards in the causation of communicable diseases and to intervene if required;

(g) improving early diagnosis and adequate treatment capacities for communicable diseases in the primary health care system;

(h) establishing monitoring systems of epidemiological data to ensure adequate forecasting of introduction, spread or aggravation of communicable diseases, followed by appropriate intervention.

C. MEETING THE URBAN HEALTH CHALLENGE

Basis for Action

64. For hundreds of millions of people, the poor living conditions in urban areas are destroying lives, health, and social values. Urban growth has outstripped society's capacity to meet human needs, leaving hundreds of million of people with inadequate incomes, inadequate diets, inadequate housing and services, and exposed to environmental pollution. Urban growth has outstripped the capacity of municipal governments to deal with solid waste collection and disposal, with air pollution from road traffic, industrial activities and other sources. Neighborhood environments and housing are damaging to health, and people are often exposed to air pollution, pollution (and inadequate supply) of water, heavy traffic, excessive noise, and indoor air pollution associated with burning of biomass fuels for heating and cooking. All too often urban development is associated with destructive effects on the physical environment and the resource base needed for sustainable development.

65. "Air pollution (indoor and outdoor) is associated with excess morbidity and mortality from asthma and bronchitis and water pollution with diarrhoeal disease, hepatitis, and other conditions. Overcrowding and inadequate housing contribute to respiratory diseases, tuberculosis (which is on the rise in countries where the incidence of AIDS is high, particularly in adults), meningitis and other conditions. Poor environmental conditions in residential areas (including inadequate security of tenure, and such problems as noise and heavy traffic) make a further contribution to stress, mental problems, accidents, violence, anti-social behaviours and drug and alcohol abuse.

Objectives

66. The objective is to improve human health (and socio-economic conditions) in urban areas, including the health and well-being of homeless people and of low-income settlement dwellers in cities.

67. Health includes physical, psychological and social aspects, as measured by reduction in mortality and morbidity from infectious and non-infectious diseases, reduction in psychosocial problems, improved child development, and greater social well-being.

68. Targets could be expressed by an improvement in the following health and environmental indicators. It must be recognised that there are wide variations in the current status of the following indicators, between nations, between cities within nations, and perhaps most importantly within cities themselves, i.e. the intra-urban variation. Studies of health status in developing country cities indicate that intra-urban variation in infant mortality rates of 3-5 times is not uncommon. Consequently it is important that each city set targets based on its own data (including the intra-urban variation), and commonly targeting a 10-40 per cent improvement in each indicator over a decade. Reduction of intra-urban variations (ie greater health equity) should be a priority in all cities.

69. The specific indicators of greatest utility in target setting for health status include the infant mortality rate (IMR); the percentage of children whose weight-for age and/or weight-for-height are acceptable; the percentage of newborns weighing at least 2500 grams at birth; life expectancy at birth, by sex, in all identifiable subgroups; specific disease rates (particularly respiratory diseases and tuberculosis, as indicators of crowded housing, diarrhoeal diseases, as indicators of inadequate water and sanitation), including incidence rate and mortality rate, industrial accidents, and social problems (drug and alcohol abuse, crime); and transport accidents (deaths and injuries).

70. With regard to related areas of housing provision and urban environmental quality also targets need to be set. These issues have been dealt with in other documents on air pollution (A/CONF.151/PC/59), freshwater (A/CONF.151/PC/42/Add.7), and human settlements (A/CONF.151/PC/56).

Activities

71. Urban development, when guided by the above objectives, includes the following activities:

(a) development of a municipal health plan including relevant social and environmental components. This requires (a) political commitment of the city to improved health and well-being, and reduced inequalities in the city; (b) building-up of intersectorial committees at both the political and technical level; and (c) establishing collaborating links with scientific, cultural, medical, business, social and other city institutions, using networking to gain political support and mobilize resources for technical programmes to improve health and the environment;

(b) strengthening of community participation in urban improvement activities, by the adoption of an "enabling strategy" by the municipality, that emphasises "doing with" rather than "doing for" (or providing services for);

(c) raising awareness, through (a) public education for health (in schools, work place, mass media, etc.); (b) survey of the existing health, social and environmental conditions in the city;

documentation of intra-urban differences can be a valuable strategy to draw public attention to problems, to assist urban managers and planners in their work, and in mobilizing resources;

(d) strengthening of environmental health capabilities, to provide environmental services in water supply, sanitation, solid waste management and pollution control, and to allow use of health impact and environmental impact assessment procedures for urban development projects; this may involve basic training and in-service training of new and existing personnel;

(e) establishment of collaborative activities and links with other cities (city networks), in order to exchange models of good practice;

72. The WHO "healthy cities" programme includes all of the above elements. The above activities involve the municipal government, with participation by community organizations, and scientific, cultural, medical, business, social and other city institutions.

D. REDUCING HEALTH RISKS FROM ENVIRONMENTAL POLLUTION AND HAZARDS

Basis for Action

73. In many locations around the world the general environment - air, water and land - work places and even individual dwellings are so badly polluted that the health of hundreds of millions of people is adversely affected. This is due to past and present developments in energy production and use, in industry, in transportation, etc., with little or no regard for environmental protection. While there have been notable improvements in most of the developed countries, this has not happened, as a rule, in the developing countries where the deterioration in environmental conditions continues.

74. Most severe development-related environmental health hazards exist in the newly industrialized countries. Pollution control and health protection measures have not kept pace with economic progress. A recent WHO study revealed that only 10 out of 60 such countries have established effective natural pollution control mechanisms.

75. This situation persists due to the lack of national priority for environmental protection, lack of the requisite programmes and infrastructures and the lack of resources for "cleaning up" the environment. While the obstacles are formidable, especially with respect to resources, major improvements can be made.

Objectives

76. The overall objective is to clean up and maintain the environment to a degree that human health is not impaired and yet allow development to proceed. Specific programme objectives are:

(a) to have appropriate environmental and health safeguards implemented as part of development;

(b) to have adequate national infrastructures and programmes in place for providing for the requisite pollution surveillance and to ensure that abatement activities are implemented;

(c) to have the necessary information on hand for identifying the health effects and supporting the most cost effective pollution control, prevention and abatement measures.

Activities

The major programme activities will be:

(a) the development of national programme capacities for environmental protection, including monitoring and assessment, with international support (multilateral and bilateral);

(b) internationally coordinated research and investigations concerning exposures and the accompanying effects due to pollution, and for developing and introducing cost-effective methods for preventing and abating pollution;

(c) operation, through EARTHWATCH, of national, regional and global projects for measuring the environmental quality and effects on health and the progress being made in these areas and for identifying new environmental risks for health.

Other programme activities are dealt with in the discussion on capacity building in the document on technology transfer (A/CONF.151/PC/53) and in the options for Agenda 21 for atmosphere (A/CONF.151/PC/42/Add.1), freshwater (A/CONF.151/PC/42/Add.7), toxic chemicals (A/CONF.151/PC/42/Add.8), hazardous wastes (A/CONF.151/PC/42/Add.9) and human settlements (A/CONF.151/PC/56).